46 A

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The beaker on the left contains water only. After one second a piece of wool placed on the surface is still floating—and will float for hours. The beaker on the right contains water and 'AGRAL' 90. After one second the wool has already sunk one inch below the surface.

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TREATMENT	PERCENTAGE OF 'PERENOX' IN SPRAY FLUID	MEAN NUMBER OF SPOTS PER LEAF	
		April 26th	May 20th
'PERENOX'	0.25	12	109
'PERENOX'+ 'AGRAL' LN	0.25+ 15 CC/100 LITRES	0.5	39

Spray dates: 9th March, 30th March, 20th April.

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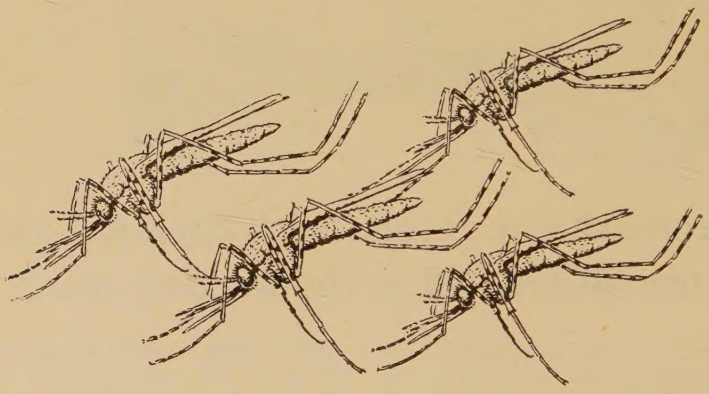

In the Philippines, dieldrin—used as a residual spray—is playing a major part in a nation-wide house spraying campaign to eradicate malaria-carrying mosquitoes (chiefly *Anopheles minimus flavirostris*) completely from the islands. Already, results are greatly encouraging. Sickness is falling sharply, in some cases by 75%. Infants are growing up free of the malaria menace. And what can be achieved in the Philippines can be repeated elsewhere.

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REVIEW

OF

APPLIED ENTOMOLOGY.

SERIES A.

Vol. 46. 1958.

MARKKULA (M.) & TINNILÄ (A.). **Studies of the Biology of the Lesser Clover Leaf Weevil, *Phytonomus nigrirostris* Fabr. (Col. Curculionidae).** —*Valt. Maatalousk. Julk.* no. 152 (1956) 62 pp., 23 figs., 46 refs. Helsinki, 1957. (With a Summary in Finnish.)

The authors briefly describe all stages of *Hypera* (*Phytonomus*) *nigrirostris* (F.), the most important pest of red clover (*Trifolium pratense*) in Finland, review its world distribution, and give an account of investigations on its bionomics in the insectary and field near Helsinki in 1953–55. The observations on oviposition in 1954 have already been noticed [*R.A.E.*, A **44** 249], and those in 1955 confirmed the earlier results.

The first larvae hatched at the beginning of June in 1953–54, when the weather was unusually warm, but some four weeks later in 1955, when it was cool. They were not very active and preferred sheltered positions. They attacked almost exclusively the younger growth of the clover, and were often found between the stipules, feeding on the young shoots, or, in the case of the older larvae, on the main stem [*cf.* **36** 115]. Some of them moved to the buds and, if they were present sufficiently late in the season, they frequently occurred between the bracts and fed on the florets or penetrated into the head between the florets. In 1955, as many as 60 per cent. of the larvae were found in the inflorescences. Usually one and never more than two larvae were observed in one stipule or inflorescence at a time. The cocoons were generally formed within the stipules or inflorescences. The larvae were present for six weeks in 1953–54, pupae were found from late June to mid-July, and the first adults of the new generation appeared in the second week of July. In 1955, the larvae were present for only four weeks, the pupae occurred from about 20th July to 5th August, and the first adults appeared on 29th July. They fed mainly on the leaves and to a lesser extent on the stipules and stems, and entered hibernation in the clover fields after mid-August. There was only one generation a year. Under natural conditions in the insectary, the duration of the egg stage ranged from 8 days at about 21°C. [69·8°F.] to 30 days at 11·5°C. [52·7°F.], that of the larval stage from 14 days at 20·4°C. [68·7°F.] to 20 days at 17·1°C. [62·8°F.] and that of the pupal stage from 10 days at 18·6°C. [65·5°F.] to 16 days at 16·6°C. [61·9°F.].

Although red clover was preferred by both larvae and adults, eggs were observed on alsike and zigzag clovers (*T. hybridum* and *T. medium*) in the field, and development was completed on these and on white clover (*T. repens*) in the insectary.

(2562) Wt. P8510/3911 1/58 E.P. td. Gp. 566. [A]

Brandt (H.). **Welcher Schädling ist das? Schädlinge und Krankheiten an landwirtschaftlichen Kulturpflanzen.** [What Pest is that? Pests and Diseases of agricultural Crops.]—Kosmos-Naturführer, 158 pp., 8 col. pls., text illus. Stuttgart, Franckh'sche Verlagshandl., 1957. Price *DM.* 11.80 cloth; *DM.* 9.80 paper cover.

The field crops dealt with in this handbook for agriculturists in Germany include, notably, cereals, pasture grasses, leguminous fodder crops, root crops, oil-seed plants, tobacco, hops, flax and hemp, and the information given on their pests and diseases resembles in scope and arrangement that in a companion volume already noticed [*R.A.E.*, A **45** 453].

Drees (H.) & Schwitulla (H.). **Über Parasitierungs-Versuche bei** *Lymantria dispar* **L. mit** *Apanteles solitarius* **Ratz. W.** [Tests on the Use of *A. solitarius* against *L. dispar*.]—*Anz. Schädlingsk.* **29** pt. 6 pp. 81–85, 6 figs., 18 refs. Berlin, 1956.

Investigations on the effectiveness of *Apanteles solitarius* (Ratz.) as a parasite of *Lymantria dispar* (L.) were made in a fairly well isolated plot containing 53 assorted fruit trees and other vegetation near Cologne. The bionomics of the two insects are described, and it is stated that the fertilised females of *A. solitarius* overwinter in low vegetation, in sheltered sites at the base of the trees and in cracks in the bark and resume activity 8–14 days before the overwintered eggs of *L. dispar* begin to hatch. They lay only one egg per larva and fly but little, so that parasitism tends to be concentrated in limited foci. The full-fed parasite larva leaves the host and pupates close by it, the pupal stage lasting 10–14 days.

The plot had been neglected, infestation by *L. dispar* was heavy, and *A. solitarius* was present in 1950, when the observations began, only on one plum tree, on which 31 of 68 larvae were parasitised by it. In the spring of 1951, seven egg-masses of *L. dispar* were found on this tree, from which 2,100 larvae were expected to develop. Further egg-masses were taken from other trees and added to the seven, to ensure that the parasite should multiply at its maximum rate, and it was later found that 2,961 of the 4,837 larvae that hatched were parasitised by it. Of the resulting *Apanteles* cocoons, 2,000 were distributed in equal numbers over 20 further trees, and further observations were made in 1952. In that year, 5,747 cocoons of *A. solitarius* were found, almost all of them on the lower half of the trees and none on the uppermost parts; over 80 per cent. of them were on the south-east side of the trees, where most of the young *Lymantria* larvae occur. In 1953, over eight times as many cocoons were found at the base of the south-east side of the trees as in 1952, and a similar rate of increase was observed on trees on which the parasite had not previously occurred but on which cocoons had been placed in 1952. *A. solitarius* was found to have spread almost throughout the plot in 1953 and to have brought *L. dispar* under satisfactory control, whereas collection of the larvae and chemical methods were still required in neighbouring areas.

Kovačević (Ž.). **Die Nahrungswahl und das Auftreten der Pflanzenschädlinge.** [Food-plant Selection and the Occurrence of Plant Pests.]—*Anz. Schädlingsk.* **29** pt. 7 pp. 97–101, 8 refs. Berlin, 1956.

An account is given of experiments carried out at Zagreb in 1950–55 to study the effects of different food-plants on the population dynamics of four polyphagous Lepidoptera that are pests of deciduous trees in Yugoslavia. Most of them concerned *Lymantria dispar* (L.), outbreaks of which occur

frequently in forests in certain parts of the country. Field-collected egg-masses of this species on oak (*Quercus robur* (*pedunculata*)) were transferred to the laboratory in early 1950, and the larvae were reared on leafy twigs of oak (*Q. robur* or *Q. sessiliflora*), hornbeam, beech, apple or plum. The cultures on *Q. robur* maintained themselves throughout the six years, though mortality was fairly high and reached 98 and 99 per cent. in 1951 and 1955, respectively, those on *Q. sessiliflora* died out in 1955, and those on the other trees died out almost every year, so that eggs had to be introduced from the cultures on oak. The food-plant affected the duration of development, that of males ranging from 79 days on beech to 70 days on *Q. robur* and that of females from 81 days on apple to 68 days on hornbeam, with some variation according to the origin of the cultures. Females usually had five moults, but some had four or six, and males reared on *Q. sessiliflora* or beech also had five, all others having only four. Outbreaks on *Q. robur* in forests usually last 4–5 years and those on beech 2–3, and that their duration is affected by the food-plant was confirmed in a test in which larvae from the coastal area, where *Q. ilex* is the main food-plant, showed 26 per cent. mortality on this tree, 60 per cent. on bitter cherry, 83 and 86 per cent. on *Ostrya carpinifolia* and *Q. cerris*, and 98 per cent. or more on *Q. sessiliflora*, *Q. robur*, hornbeam, beech, apple and plum. Some of the mortality in the main tests was caused by polyhedral disease, which is considered to be present in all populations of *L. dispar*. There was an outbreak of it in 1951, but whereas it did not cause complete mortality of the larvae on oak, it did so on all the other plants. Mortality due to this disease usually becomes high during the later stages of an outbreak of *L. dispar*, and the influence of the less favourable food-plants on it is held to be exercised through their contribution to the general physiological weakening of the insect population. Other diseases are favoured in like manner. Outbreaks of *L. dispar* can thus persist only on the most favoured food-plants, which appear to be *Q. robur* in the lowlands of Croatia, *Q. ilex* in the coastal area and *Q. coccifera* in Macedonia. There may be still other local races or ecotypes.

The tests with the other insects were less detailed. *Malacosoma neustria* (L.) is mainly a pest of fruit trees but also infests oaks. Cultures originating from fruit trees throve on leaves of the same species in the laboratory, and transfer of eggs or young larvae from *Q. ilex* to a mixture of leaves of *Q. ilex* or fruit trees had no ill effects. *Euproctis similis* (Fuessly) (*chrysorrhoea*, auct.) is a pest of oaks, fruit trees and *Arbutus unedo*. The rearing tests showed little difference in the suitability of leaves from these trees, but mortality was rather high and fewer eggs were laid when individuals from *A. unedo* or plum were transferred to pear. The introduced *Hyphantria cunea* (Dru.) is highly polyphagous. In 1953, three generations were reared on mulberry, plum, cherry, apple, walnut and hornbeam, two on lilac and one on oak, and the reproductive potential was highest on the first two and (in the first generation) on hornbeam. Not more than two generations developed in 1954, and reproduction was again greatest on mulberry and plum. Climate is therefore held to be of equal importance with food-plants in the occurrence of outbreaks of this insect.

Tanasijević (N.). **Morfologija i razviće surlaša** *Tychius flavus* **Beck.** [Morphology and Development of *T. flavus*.]—*Plant Prot.* no. 29 pp. 3–33, 5 pls., 12 figs., 4 graphs, 14 refs. Belgrade, 1955. (With a Summary in English.)

Tychius flavus Becker is an important pest of the seed pods of lucerne in Yugoslavia. The author describes all stages of this weevil and the

genitalia of both sexes, and gives an account of investigations on its bionomics [*cf. R.A.E.*, A **39** 72], carried out near Zemun in 1952–54. The adults overwintered in the cocoons and appeared in the fields at the end of March or the beginning of April, when the average daily temperatures of the air were 11°C. [51·8°F.] or above and the average soil temperatures were above 12·4°C. [54·32°F.]. They survived above ground for 10–12 months and did little direct damage, though their feeding on the flowers caused withering if attack was heavy. Maturation feeding continued for up to 90 days, and pairing was first observed in early June. Oviposition began after mid-June, the eggs being inserted into the pods through the edges. Eggs were laid singly, at the rate of up to 42 per female. The larvae hatched in 5–11 days at 24–28°C. [75·2–82·4°F.], provided that the relative humidity exceeded 60 per cent., and fed in the seeds for 15–20 days, at an average temperature of 24°C., after which they entered the soil and pupated after 6–12 days at depths of not more than about 3 ins., pupae being first observed in early August. The pupal stage lasted 14–17 and 7 days at constant temperatures of 22 and 30°C. [71·6 and 86°F.], respectively.

Gradojević (Z.). *Meigenia bisignata* **Mg. (Dipt., Tachinidae) parazit lucerkine bube.** [*M. bisignata*, a Parasite of *Phytodecta fornicata.*]—*Plant Prot.* no. 29 pp. 57–61, 3 figs., 1 ref. Belgrade, 1955. (With a Summary in French.)

Meigenia bisignata (Mg.) was observed in 1952 parasitising the larvae of *Phytodecta fornicata* (Brüggem.) on lucerne near Belgrade. The females of this Tachinid appeared in early May and laid their eggs on the second- and third-instar larvae. Parasitised larvae continued their development and entered the soil, but did not pupate. The Tachinid pupated within the skin of the host larva 2–3 days later. The percentage parasitism among larvae collected in one lucerne field was 13.

Lazarević (B.). **Biologija i suzbijanje višnjevog svrdlaša.** [The Bionomics and Control of *Rhynchites auratus.*]—*Plant Prot.* no. 30 pp. 11–36, 6 pls., 1 graph, 9 refs. Belgrade, 1955. (With a Summary in English.)

The author describes all stages of *Rhynchites auratus* (Scop.), which is an important but little known pest of cherry and sour cherry in Serbia, damaging up to 98 per cent. of the fruits of sour cherry, and gives an account of observations on its bionomics in 1950–54. The weevil hibernates in the soil as a full-fed larva or sexually immature adult. The overwintering larvae remain in diapause until the end of the following summer, when they pupate and give rise to adults that overwinter. The overwintered adults appear in the orchards in early April at soil temperatures of 8–10°C. [46·4–50°F.], and feed on the flower and leaf buds and later on the young fruits. They pair after about a month, and the females lay their eggs in the fruits, the total number of eggs per female ranging from 56 to 121. The larvae hatch in 15 days at an average temperature of 17°C. [62·6°F.] and enter the stones of the fruits and feed on the kernels. They leave when full-fed and enter the soil, where a few of them pupate at the end of summer (August–September), giving rise to adults that overwinter, and the majority enter diapause. Control is best effected by spraying with about 0·15 per cent. DDT when the fruits begin to form, with a preliminary application before flowering if infestation is heavy.

Mijušković (M.) & Mirčetić (S.). **Ogledi suzbijanja maslinove mušice parationskim sredstvima na Crnogorskom Primorju.** [Experiments on the Control of *Dacus oleae* by Means of Parathion on the Coast of Montenegro.]—*Plant Prot.* no. 31 pp. 45–59, 1 pl., 4 graphs, 6 refs. Belgrade, 1955. (With a Summary in French.)

Dacus oleae (Gmel.) causes 40–50 per cent. loss of olives on the Montenegran coast of Yugoslavia, and experiments on its control by means of E-605 forte, which contains 46·7 per cent. parathion, were carried out in 1954. Sprays of 0·06, 0·08 and 0·1 per cent. E-605 forte were applied in early September or early October or at both periods, and the results showed that the lower concentrations were ineffective, even when two applications were made, and the highest effective only when applied in September or on both dates, when it gave 79·8 and 86·2 per cent. kill of larvae in the olives, respectively. Mortality rose sharply 4–5 days after the first application, so that absorption of parathion by the fruits requires about this period, and it continued throughout the period of the test.

Radović (M.) & Despotović (P.). **Rezultati suzbijanja ambarskih štetočina preparatom Phostox.** [The Results of controlling Granary Pests with the Preparation Phostox.]—*Plant Prot.* no. 31 pp. 85–92, 3 refs. Belgrade, 1955. (With a Summary in English.)

Phostox tablets, which give off phosphine at the rate of 1 gm. per tablet on contact with moisture [*cf. R.A.E.*, A **45** 294], were tested for the control of pests of stored grain in Yugoslavia in 1954–55. The dosage recommended by the German manufacturers against *Calandra granaria* (L.) is 20–25 tablets per ton, but complete mortality of adults of this weevil and of *Sitotroga cerealella* (Ol.) was given by a dosage of 17 tablets per ton applied in two halves with an interval of four days. This was the maximum rate tested, but it did not completely control the immature stages.

Mijušković (M.). **Ogledi suzbijanja smokvinog mediča u NR Crnoj Gori.** [Experiments on the Control of *Ceroplastes rusci* in Montenegro.]—*Plant Prot.* no. 32 pp. 43–47, 1 fig., 6 refs. Belgrade, 1955. (With a Summary in French.)

Ceroplastes rusci (L.) is injurious to fig trees in Montenegro in certain years. Damage was severe in 1952–54, and tests on control showed that good results were given by sprays of 0·03 per cent. E-605 forte [which contains 46·7 per cent. parathion] or 1·5 per cent. white oil emulsion, applied in July, as soon as the crawlers had established themselves on the leaves. Winter sprays of various DNC products were also effective [*cf. R.A.E.*, A **43** 393], but had to be applied at concentrations higher than those used against other pests.

Baggiolini (M.). **Contribution à l'étude d'une lutte rationelle contre la tordeuse** *Cacoecia rosana* **L.**—*Rev. rom. Agric.* **12** no. 3 pp. 21–24, 4 figs., 6 refs. Lausanne, 1956.

Tortrix (*Cacoecia*) *rosana* (L.) has recently caused increased injury to fruit trees, especially apple, in the Canton of Vaud, Switzerland, and investigations were carried out there in 1954–55 on its habits, especially those of the

larvae, and on its control. Hatching began in early April and was almost complete by the end of the month, when the apple blossom was at the pink-bud stage, the date depending on the position of the egg-masses on the tree. The larval stage lasted for up to 55 days, and buds, leaves and young fruits were attacked [*cf. R.A.E.*, A **41** 48]. Pupation occurred at the feeding site, and the pupal stage lasted 15–21 days. Adults were present from the end of May to early July, and the eggs were laid chiefly in June and July and overwintered. Observations on natural enemies showed that *Trichogramma evanescens cacoeciae* Marchal [*cf.* **37** 116] was a common parasite of the eggs of *Tortrix rosana*, 6·3 per cent. of which were attacked by the winter generation and 24·8 per cent. by the summer one, the two generations often developing in the same egg-masses [*cf.* **15** 654]. Predators, including Syrphid larvae, killed 8 per cent. of the larvae, and Hymenopterous parasites, of which the most important were *Itoplectis maculator* (F.), *Lissonota* sp., *Pseudomicromelus deplanatus* (Nees), and *Monodontomerus aereus* Wlk., caused 44 per cent. mortality of the pupae.

In dormant applications against the eggs on apple, the only spray to give effective control was 4 per cent. oil emulsion, which gave 87 per cent. kill when applied in winter and 86 per cent. when applied just before bud burst. Against the larvae, the best results were given by emulsion sprays of parathion, which gave 27, 89 and 88 per cent. control when applied at 0·5 per cent. in early April, at the pink-bud stage, and after petal fall, respectively, and 40, 95 and 61 per cent. control when similarly applied at 0·1 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] applied at 0·1 per cent. at the pink-bud stage gave 94 per cent. control. Treatment in early April was unsatisfactory because hatching had only just begun, and it was injurious to the winter generation of *Trichogramma*, and the inferior results obtained after petal fall were due to the protected feeding sites of the larvae. Sprays are therefore best applied at the pink-bud stage, just before all the larvae have hatched.

Blache (M.) & Bournier (A.). **Dégâts de thrips sur pêchers.**—*Phytoma* **9** no. 85 pp. 7–11, 3 figs. Paris, 1957.

Taeniothrips inconsequens (Uzel) and *T. vulgatissimus* (Hal.) (*meridionalis* (Priesn.)) have recently caused deformation of peaches in the department of Pyrénées-Orientales, France, and investigations were carried out there in 1955–56. The bionomics of *T. inconsequens* are described [*cf. R.A.E.*, A **23** 22, etc.], and those of *T. vulgatissimus* are thought to be similar. On peach, the eggs are laid on the organs of the flowers, and the nymphs are numerous by petal fall. They attack the pistils, causing black scars that enlarge with the fruits and result in deformation. After the fruits have set, the nymphs attack the young shoots and leaves, causing the latter to drop when infestation is severe. The adults do not fly readily, and infestation therefore spreads only slowly. Infestation was high in 1954–55, but lower in 1956, owing to the preceding wet autumn and cold winter, which killed the nymphs after they had entered the soil to pupate and the newly emerged adults, respectively. Since legislation prohibits the use of insecticides on fruit trees at flowering time, when the nymphs do most damage, a spray containing 0·2 lb. parathion per 100 gals. was applied at petal fall in 1955. Counts showed that it protected 95 per cent. of the fruits from damage. Various organic insecticides were applied in sprays at the same period in 1956, but the results were inconclusive because of heavy rain. DDT and BHC appeared to be as effective as parathion, but malathion and toxaphene seemed less satisfactory.

Milaire (H.). **Note sur le développement et le caractère des attaques de la mouche méditerranéenne des fruits** (*Ceratitis capitata* **Wied.**) **dans la moyenne vallée du Rhône.**—*C.R. Acad. Agric. Fr.* **42** no. 10 pp. 504–508. Paris, 1956.

Following severe damage in 1949 to peaches and pears in the Lyons region of the Rhône valley by *Ceratitis capitata* (Wied.), investigations were carried out each year on the incidence of this fruit-fly by means of counts of infested fruits and bait-trap catches in orchards. It was found that attack was heavy in 1950 and 1955, fairly heavy in 1952 and light in 1951 and 1953–54. Peaches, apricots and pears were most infested, and attack usually occurred late in the season. Of 23 localities in which infestation was found in 1955, 12 were near Lyons, and the remainder near other towns or villages. The bait-trap catches generally reflected the incidence of attack, but the adults responsible for the earliest infestations of the year were never taken, larvae often being present in the fruits when the adults were first captured. It is estimated that the earliest adults in 1952 appeared in early June as adults of the first generation were observed in mid-July and those of the second and third in mid-August and late September, respectively, and similar results were obtained early in the season in 1955. There is considerable overlapping of generations in the field. The fruit-fly has not been proved to overwinter in this area [*cf. R.A.E.*, A **45** 455], and the first adults to appear are thought to emerge from imported fruits. In 1953, six adults emerged between 22nd and 26th June from two grapefruits found infested in the market in Lyons on 29th May, and a further generation was reared on peaches and apricots grown locally, the adults emerging on 3rd August. The fact that the principal centres of infestation were near populated areas [*cf.* **42** 184] suggests that the fruit-fly is not endemic.

Coulon (J.). **Essais comparatifs de laboratoire sur l'action de divers insecticides sur la mouche de l'asperge** (*Platyparea poeciloptera*).—*Phytiat.-Phytopharm.* **4** no. 4 pp. 165–169. Paris, 1955.

In laboratory experiments on the relative toxicity of various organic insecticides to the asparagus fly, *Platyparea poeciloptera* (Schr.), adults were placed in batches of ten in flasks bearing known internal deposits from ether solutions of the insecticides. They were transferred to clean flasks after ten minutes and observed for mortality after a further hour. It was calculated from the results that the deposits in μg. per sq. cm. giving 50 per cent. kill were 0·2 for γ BHC, 0·26 for diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], 11·47 for parathion, and 24·78 for DDT. When mortality was determined at times ranging from 0·5 to 7 hours after exposure, the shortest periods (in hours) in which complete kill was obtained, and (in brackets) the respective concentration in μg. per sq. cm., were 0·5 (5·1) and 2 (0·17) for diazinon, 1 (0·51) and 3 (0·17) for γ BHC, and 2 (10·1), 3 (5·1) and 6 (0·51) for parathion, and 2 (45·9) for DDT. Dieldrin at 5·1 μg. per sq. cm. proved totally ineffective.

Hurpin (B.). **Action de l'aldrine et du lindane sur les larves de** *Melolontha melolontha* **L.**—*Phytiat.-Phytopharm.* **4** no. 4 pp. 197–201, 2 graphs, 7 refs. Paris, 1955.

As an aldrin dust applied round strawberry plants and worked in to the soil in early April at rates of 0·9 and 1·8 lb. toxicant per acre failed to control third-instar larvae of *Melolontha melolontha* (L.) attacking the plants, laboratory experiments were carried out at Rouen in the winter of

1954–55 in which dusts and emulsified solutions of aldrin and γ BHC were tested against second- and third-instar larvae. They were mixed at four rates with garden soil, and pots filled with the treated soil were infested with two larvae each (for which food was supplied), watered regularly, and covered to reduce evaporation. Mortality was calculated according to Abbott's formula [*R.A.E.*, A **13** 331] 15–90 days later. The mortality percentages for the second- and (in brackets) the third-instar larvae were 99 (40) after 90 days for aldrin at 4·32 lb. per acre (the highest rate tried) in emulsified solution, 100 (13) after 90 days for aldrin at 4·5 lb. per acre (the highest rate tested) in a dust, 100 (50, 38 and 13) after 90, 30 and 15 days for γ BHC in emulsified solution at 1·08, 2·16 and 4·32 lb. per acre, respectively, and 100 (28 and 37) after 15 days for γ BHC at 1·8 and 3·6 lb. per acre in a dust. Complete mortality of third-instar larvae was given in 90 days by γ BHC at 4·32 lb. per acre in an emulsified solution and in 90 and 45 days by γ BHC at 2·7 and 5·4 lb. per acre, respectively, in a dust. Treatment with γ BHC at 0·9–1·35 lb. per acre is recommended for control where infestation is light, but the rate should be doubled if it is severe. Aldrin should be used in preventive treatments at 2·25–2·7 lb. per acre.

Fedotov (D. M.). Ed. **The Noxious Little Tortoise,** *Eurygaster integriceps* **Put. Work of the Laboratory of Invertebrate Morphology in Connection with the Expedition to the Province of Krasnodar in 1949–1953. Vol. 3.** [*In Russian.*]—278 pp., 76 figs., many refs. Moscow, Akad. Nauk SSSR, 1955. Price 16 *rub.* 80 *kop.*

This third volume of a work on *Eurygaster integriceps* Put. in the Soviet Union [*cf. R.A.E.*, A **40** 307] is based on the results of observations in the Province of Krasnodar in 1949–53, during an outbreak of this Pentatomid on cereals, and consists of a general introduction by the editor and five scientific papers, abstracts of which appear below.

Fedotov (D. M.) & Bocharova (O. M.). **The Dependence of the morpho-functional Condition of** *E. integriceps* **on its Conditions of Life** (pp. 7–67, 25 figs.). Investigations in 1949–53, which are described, confirmed the earlier finding [*cf.* **40** 308] that populations of *E. integriceps* differ not only in their density, but also in the morpho-functional condition of the individuals comprising them. Notes are given on the various active and passive phases in the life-cycle of the bug [*cf.* **40** 309] and on the appearance of its internal organs, which are indicative of its degree of vitality, followed by the results of regular dissections of individuals in all phases of the life-cycle during the five years. A high degree of vitality resulted from favourable environmental conditions in 1948–49, leading to a severe outbreak of the bug, but there was a subsequent gradual decline as a result of drought during the early autumn of 1950, fluctuations in temperature in the ensuing winter, and cold wet weather in spring and early summer in 1951 and 1952, when the bugs were migrating from their hibernation quarters to the grain fields, though the process was somewhat slowed down by favourable conditions for the feeding of the young adults in both these years. The outbreak apparently reached its peak in 1951, and little damage was caused in 1953. The decline was only temporary, however. It is concluded that increases and decreases in the population density of the pest are conditioned by gradual physiological changes in consecutive generations brought about by variations in environmental conditions.

Strogaya (G. M.). **Significance of some biochemical Components in the individual Development of** *E. integriceps* (pp. 68–133, 8 graphs.). The contents of water, fat and reducing substances and the changes in total

weight and weight of dry matter in nymphs and adults of *E. integriceps* were investigated in 1950–52 from examples collected at intervals from various natural habitats in Krasnodar, first-instar nymphs being disregarded on account of their small size, and the material was also subjected to morpho-functional analysis. The results, which are discussed in detail, showed that the life-cycle of *E. integriceps* can be divided into four phases characterised by differences in metabolism. The first is the nymphal stage, in which intensive feeding in grain fields is accompanied by no increase in the relative content of fat or other dry matter, the food ingested being used for purposes of growth. The second phase lasts from adult emergence until migration to the hibernation quarters, during which period feeding leads to the accumulation of reserve substances in large quantity. The third phase is that of hibernation and the return to the grain fields, during which the accumulated reserves are largely exhausted, and the fourth lasts from the return to the fields until death and is characterised by intensive feeding and several cycles of reproduction. At the beginning of this phase, only the females still contain any considerable reserves [*cf.* **45** 305], and these are used for the development of the first eggs. It is concluded that observations on the accumulation and utilisation of fat reserves are useful as a supplement to morpho-functional analysis in forecasting outbreaks of the bug.

Ushatinskaya (R. S.). **Physiological Peculiarities of *E. integriceps* in the Period of Quiescence with Hibernation in the Mountains and in the Plain** (pp. 134–170, 11 graphs.). In Krasnodar, *E. integriceps* spends some 9–10 months of the year in its hibernation quarters in forests in the mountains or in the plains, the adults leaving the grain fields in June–July and returning to them in April–May, and investigations were made in 1951–52 on the metabolism of the bugs during this period in relation to temperature. Some of the results have already been noticed [*cf.* **43** 123]. Climatically, the quiescent period can be divided into three parts. During the first 4–4½ months, the temperature is above freezing point, during the next 4–4½ months it is below it, and for 2–3 weeks in spring, it is again above it and activity is resumed. Such a long period of survival without feeding is facilitated by a diapause, during which metabolism is reduced and its direction changed. This condition sets in before migration from the fields, and it lasts until the end of January or the beginning of February. The metabolism of the bugs during quiescence can be divided into three phases coinciding with the three climatic periods. In the first, metabolic activity is still fairly high (though it is much reduced by the diapause), and fats and food substances participate in it. At the end of this phase, when the temperature falls below 10°C. [50°F.], the glycogen content increases, providing the fundamental source of energy for the second phase. During this, the bugs become torpid and their metabolism falls to a very low level. Carbohydrates are utilised, but not fats, except during warm spells when the temperature exceeds 0–2°C. [32–35°F.]. During the third phase, when the internal sex organs resume activity, metabolism increases, fats being utilised and carbohydrates produced.

Specific physiological adaptations permitting *E. integriceps* to survive the quiescent period were shown to be the synthesis of glycogen from fat before the onset of winter, an increase in the content of reducing substances during the cold period, and an increase in the iodine number of the fat, and hence in the content of unsaturated fatty acids, after the diapause. The hind-gut, in which uric acid and its salts are accumulated, serves as a hygroregulative apparatus during the cold period, when the water content of the body is high; the reserves of food, consisting chiefly of carbohydrates and proteins, stored in the mid-gut provide an additional source of energy. Males and females that had overwintered on the northern slopes of the mountains resumed activity with 56·5 and 64·3 per cent. of the

quantity of fat, 60·4 and 76·5 per cent. of the food reserves and 87·4 and 84·2 per cent. of the carbohydrates that they had contained before hibernation. Individuals overwintering on southern slopes used more of their fat and food reserves, and those hibernating in the plains weighed less, had smaller accumulations of fat and food reserves and contained more reducing substances than those doing so in the mountains.

Arnol'di (K. V.). **The Hibernation of** *E. integriceps* **in the Mountains of the Kuban, from Investigations in 1949–53** (pp. 171–237, 19 figs.). Populations of *E. integriceps* can be divided into two main biological types according to their mode of hibernation. The first is characteristic of central Asia, where the bugs migrate from the grain fields for long distances to aestivate and later hibernate in the mountains [*cf.* **40** 309–310], and also occurs in the Crimea and the Caucasus region. The other is non-migratory, the flights to winter quarters being quite short, and populations of this type are subdivided into sedentary mountain and sedentary lowland populations. The former develop on wild grasses in the mountains, and the latter in grain fields in forest districts in the steppes. The populations that occur in the Kuban district, to the north-west of the Caucasus range, are mainly migratory, and observations on their hibernation habits were made in 1949–53. The adult bugs leave the fields in July and fly south to the mountain forests. Aestivation merges into hibernation, with no great change in distribution of the insects [*cf.* **45** 304], but the bugs do not become completely immobile until the onset of winter. The weaker individuals do not penetrate beyond the foothills, the bulk of the population seeks the lower mountains, and the physiologically stronger bugs go still higher. The various biotopes concerned are described in detail. The return to the fields in spring is gradual, beginning in March or April and depending on temperature. Other populations overwinter in small numbers in forests in the lowlands, where they are exposed to excessive dampness and even flooding; these are thought to be physiologically weak populations or such as have been delayed in development.

Fedotov (D. M.) & Bocharova (O. M.). **Effect of the Preparation DDT and some organic Phosphorus Insecticides on** *E. integriceps* (pp. 238–275, 13 figs.). A detailed account is given of laboratory and field investigations in 1950–53 on the effect of DDT on *E. integriceps*, the main results of which have already been noticed [**42** 70–71; **44** 10]. Subsidiary laboratory tests were also carried out with several proprietary phosphorus preparations in sprays, including parathion. These were more rapid in action than DDT, and the pathological effects of both are attributed to a disturbance of cell metabolism due to the blocking of enzyme systems.

Walters (J.) & McMullen (L. H.). **Life History and Habits of** *Pseudohylesinus nebulosus* **(Leconte) (Coleoptera: Scolytidae) in the Interior of British Columbia.**—*Canad. Ent.* **88** no. 5 pp. 197–202, 4 figs., 6 refs. Ottawa, 1956.

Pseudohylesinus nebulosus (Lec.) occurs commonly in Douglas fir, *Pseudotsuga menziesii*, from British Columbia to Mexico and primarily infests thin-barked slash, although saplings are also attacked and sometimes killed by it [*cf. R.A.E.*, A **16** 93]. It is chiefly of importance as a competitor of *Dendroctonus pseudotsugae* Hopk., with which it is usually associated, and field and laboratory studies of its bionomics were accordingly made in the interior of British Columbia in 1955. Although Douglas fir is preferred, *Thuja plicata*, *Abies grandis*, *A. amabilis* and *Tsuga heterophylla* are also attacked on the coast and *T. heterophylla* and *Pinus ponderosa* in

the interior of the Province. The construction of egg-galleries by paired adults began on 5th May, 12 days earlier than for *D. pseudotsugae*, and the number of fresh entries reached its peak on 8th May; there was none after 27th May, and until 9th May, attack was confined to slash from trees felled during the previous summer. The galleries were formed in the cambium, running vertically up and down from the entry hole, reached average and maximum lengths of 0·8 and 1·9 ins., respectively, and left the sapwood untouched. The eggs were laid singly in niches along the galleries, an average of about 18 in each gallery, and all the adults were dead by 13th July. The larvae hatched in about 15 days, and their feeding galleries began at right angles to the egg-gallery and then diverged; in the final (third) instar, they entered the inner bark. The larval and pupal stages lasted 41 and about 8 days, respectively, and the adults emerged between 15th August and 22nd September, with a peak on 27th August, in cages and from 24th August in the field. They fed and overwintered in niches bored in the bark of logs, which were sometimes extended to form galleries in which eggs were laid in the following spring.

Fox (C. J. S.) & MacLellan (C. R.). **Some Carabidae and Staphylinidae shown to feed on a Wireworm, *Agriotes sputator* (L.), by the Precipitin Test.**—*Canad. Ent.* **88** no. 5 pp. 228–231, 5 refs. Ottawa, 1956.

The following is almost entirely the authors' summary. In Nova Scotia, use of the precipitin test [*cf. R.A.E.*, A **43** 439] indicated that certain Carabids of the genera *Agonum*, *Amara*, *Clivina*, *Harpalus* and *Pterostichus* and Staphylinids of the genera *Philonthus*, *Staphylinus* and *Tachyporus* prey on wireworms in the field. Carabid and Staphylinid larvae and adults collected in all months except January, March and November from fields infested with wireworms were smeared on filter paper and tested against antiserum prepared from *Agriotes sputator* (L.), which was common in the area. The species of wireworms concerned could not be distinguished by the test, but refinement of the antiserum might make this possible.

Reeks (W. A.). **Sequential Sampling for Larvae of the Winter Moth, *Operophtera brumata* (Linn.) (Lepidoptera: Geometridae).**—*Canad. Ent.* **88** no. 6 pp. 241–246, 2 graphs, 9 refs. Ottawa, 1956.

A method of sequential sampling [*cf. R.A.E.*, A **44** 159] for the assessment of larval populations of *Operophtera brumata* (L.) on red oak (*Quercus borealis*) in Nova Scotia was developed from the results of population counts in 1952–55 [*cf.* **44** 227]. The data obtained refer to combined populations of *O. brumata* and *Alsophila pometaria* (Harris), of which *O. brumata* regularly comprised over 92 per cent. In 1953, 1954 and 1955, when defoliation on sample trees in an experimental plot averaged 78, 21 and 45 per cent., respectively, the average number of leaves per leaf cluster was 6·9, 5·6 and 5·2. The number of clusters per branch in the lower crown on severely defoliated trees averaged 26 in both 1954 and 1955, and the leaf cluster was adopted as the sampling unit; the sample comprised 12 leaf clusters taken from any part of each of eight trees [*cf.* **44** 227]. Sampling is best carried out when most of the larvae are in the fourth instar, which is usually in the second week of June on the south coast of Nova Scotia. Observations on individual trees for 2–4 consecutive years established that light, moderate and severe infestations, involving up to 12, 15–36 and over 42 larvae per tree sample, respectively, resulted in about 0–25, 35–80 and

90–100 per cent. defoliation by the end of the feeding period. This classification of infestations may not be applicable in cases of sustained attack or very recent infestation, where the leaves tend to be larger, but changes in the relationship would have to be considerable before it failed to accommodate them. The observed uniform defoliation within the crown of the trees and the solitary feeding habits of the larvae indicated a random distribution, which was confirmed by the relation between mean and variance for the larval count per leaf cluster. A table is given showing the limits in the cumulative numbers of larvae per tree sample within which infestation intensities intermediate between light and moderate and between moderate and severe are indicated, so that further sampling is necessary in order to classify the infestation more precisely. The usefulness of the method is demonstrated by an operating characteristic curve, which indicates that the risk of classifying a light infestation as severe is remote, and an average sample number curve, showing that it should rarely be necessary to sample more than eight trees.

Brown (N. R.) & Clark (R. C.). **Studies of Predators of the Balsam Woolly Aphid** *Adelges piceae* **(Ratz.) (Homoptera: Adelgidae). I. Field Identification of** *Neoleucopis obscura* **(Hal.),** *Leucopina americana* **(Mall.) and** *Cremifania nigrocellulata* **Cz. (Diptera, Chamaemyiidae).**—*Canad. Ent.* **88** no. 6 pp. 272–279, 23 figs., 7 refs. Ottawa, 1956.

In this first part of a series on the indigenous and introduced predators of *Chermes* (*Adelges*) *piceae* (Ratz.) on balsam fir [*Abies balsamea*] in eastern Canada, tables are given permitting the rapid differentiation of the native *Leucopis* (*Leucopina*) *americana* Mall. and the introduced *Leucopis* (*Neoleucopis*) *obscura* Hal. and *Cremifania nigrocellulata* Czerny [*cf. R.A.E.*, A **45** 379, etc.] in all their stages by means of characters visible for the most part with the aid of no more than a hand lens.

Rayner (A. C.). **Colorimetric Estimation of dyed Insecticide Spray Deposit using a Paper Sampling Surface.**—*Canad. Ent.* **88** no. 6 p. 279. Ottawa, 1956.

During spray trials against the European pine shoot moth [*Rhyacionia buoliana* (Schiff.)] in Ontario, a method for the intensive sampling and colorimetric estimation of deposits from dyed, oil-based insecticides was devised. Disks of filter paper, 9 cm. in diameter, stapled to flat cardboard were distributed over the test area, removed from the backing as soon as possible after spraying, to minimise fading, and loosely stacked. The dye was subsequently removed by shaking each paper in 10 ml. benzene in a colorimetric tube and the extract compared with standard ones by means of a Klett-Summerson colorimeter. The paper provided a satisfactory sampling surface for the spray used, which comprised a 10 per cent. dilution in fuel oil of a 25 per cent. DDT emulsion concentrate, with the addition of 0·5 per cent. red dye, and was applied at up to 2 gals. per acre. Comparison with deposits collected on glass indicated a reduction in optical density of about 1–2 per cent. in the deposits on the paper.

Narayanan (E. S.) & Subba Rao (B. R.). **Studies in Insect Parasitism I–III. The Effect of different Hosts on the Physiology, on the Development and Behaviour and on the Sex-ratio of** *Microbracon gelechiae* **Ashmead (Hymenoptera: Braconidae).**—*Beitr. Ent.* **5** no. 1–2 pp. 36–60, 7 figs., 26 refs. Berlin, 1955.

Bracon (*Microbracon*) *gelechiae* Ashm. was imported into India from Canada in 1944 for the control of the potato tuber moth (*Gnorimoschema operculella* (Zell.)) [*cf. R.A.E.*, A **37** 29] and is reared in large numbers in the laboratory on larvae of *Corcyra cephalonica* (Stnt.). The effect of other hosts on it was studied in experiments carried out at a constant temperature of 25°C. [77°F.] and an average relative humidity of 70 per cent. When the parasite was reared through six generations on *Scirpophaga nivella* (F.), *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) or *C. cephalonica* and 10 per cent. sugar solution was provided as food for the adults, the females survived for averages of about 30, 29 and 25 days, respectively, the total numbers of eggs laid per female averaged 220–434, 220–539 and 189–331, and the daily averages were 10, 13 and 10. Females of two generations reared on *Dichocrosis punctiferalis* (Gn.) lived for 18 and 20 days, respectively, and laid averages of 24 and 54 eggs each. Those of the second generation were allowed to oviposit on *C. cephalonica*, and the resulting females then laid 106 eggs each. The high percentage of protein and fat present in the larvae of *P. gossypiella*, which feed on cotton seeds, may be partly responsible for the increased fecundity of *B. gelechiae* reared on them. General observations indicated that larger females laid more eggs than smaller ones, irrespective of host, and that those reared on *S. nivella* or *P. gossypiella* were larger and had better developed ovaries than those reared on *C. cephalonica* or *D. punctiferalis*. The colour of the eggs of the parasite tended after several generations to resemble the colour of the host on which it had been reared.

In further experiments, the development of *B. gelechiae* from oviposition to adult emergence averaged nearly 10, 11, 12 and 15 days on *P. gossypiella*, *C. cephalonica*, *S. nivella* and *D. punctiferalis*, respectively, and although the numbers of eggs laid on *Plusia orichalcea* (F.) were much the same whether the host larvae fed on gram (*Cicer arietinum*) or tobacco, all the parasite larvae died in those developing on tobacco, except when the host larvae were very young, and mortality was even then rather high. This is attributed to accumulation of nicotine in the older hosts, which would be lethal to the parasites. In an olfactometer test carried out to determine whether the period for which the parasite was reared on laboratory hosts affected its natural host preference, nearly 73 per cent. of the females of a culture reared for seven years on *C. cephalonica* preferred that host to *G. operculella*, whereas over 64 per cent. of one reared for four generations on *S. nivella* preferred *C. cephalonica* to *S. nivella*. Statistical analysis showed both results to be highly significant.

When *B. gelechiae* was reared on *P. gossypiella*, *C. cephalonica* and *S. nivella*, the proportions of females produced in the population were about 55, 74 and 44 per cent., respectively, and similar results were obtained under mass rearing conditions. The size of the host bore little relation to the sex ratio of the parasite, and the high incidence of males in some hosts is attributed in part to a lack of external stimulation of the spermatheca in the ovipositing female, which depends on host suitability. Superparasitism also affected the sex ratio, by elimination of females. About 88 per cent. of the eggs laid by unfertilised females and about 56 per cent. of those laid by fertilised ones gave rise to adults; in the former case, these were all males, and in the latter, the ratio of males to females was about 1:3. Most of the mortality occurred in the larval stage. In a special test, the parasites were allowed to oviposit on first-instar larvae of *C. cephalonica*, which is a small host, so that superparasitism was more likely to give rise to high mortality. As the number of parasite larvae per host increased from 3 to 30, the proportion of females produced decreased from 73·6 to 9·8 per cent., whereas the total percentage of larvae that completed development fell from 53·1 to 22·8.

Zahradník (J.). **Zur Nomenklatur von** *Quadraspidiotus mařani* **Zahradník (***Quadraspidiotus schnciderі* **Bachmann) (Homoptera: Coccoidea).** [On the Nomenclature of *Q. mařani.*]—*Beitr. Ent.* **5** no. 1–2 pp. 88–90, 12 refs. Berlin, 1955.

The author claims that *Quadraspidiotus schnciderі* Bachmann is a synonym of *Q. mařani* Zahradník [*cf. R.A.E.*, A **42** 350; **45** 240], on the assumption that the original description of *Q. mařani* was published in October 1952, whereas that of *Q. schnciderі* did not appear until December of the same year.*

Dupree (M.), Bissell (T. L.) & Beckham (C. M.). **The Pickleworm and its Control.**—*Bull. Ga agric. Exp. Stas* (N.S.) no. 5, 34 pp., 4 figs., 20 refs. Athens, Ga., 1955.

Diaphania nitidalis (Stoll), which occurs throughout the south-eastern United States, is the most destructive insect pest of cantaloupe melon, cucumber and squash in Georgia. All stages of this Pyralid are described, and an account is given of observations on its life-history and control carried out in 1945–53. These indicated that the insect does not overwinter in central Georgia, where its food-plants are absent in the cold season, but flies up from the south each spring; it is active on its wild and cultivated food-plants throughout the winter in southern Florida. The eggs are deposited singly or in groups on various parts of the plant, and the larvae burrow in the fruits and stems and also injure the flowers and leaves. They pupate in cocoons spun on the plant. The eggs hatched in 3–4 days in May–June, and the larval and pupal stages lasted 9–13 and 7–10 days, respectively; it was evident that at least four generations could develop in the season. Eggs were found in the field from May to 25th September, larvae from 18th May to 10th October, and pupae until 6th December, all stages being present in June–September. Adults that emerged in early December and were kept in outdoor cages were all dead by 11th December.

Infestation becomes heavier as the season progresses, so that early planting and harvesting help to reduce damage. A trap crop of squash, which is apparently preferred, did not afford satisfactory protection to cantaloupes, and no natural enemies were found. In insecticide tests in 1945–47, mainly on cantaloupe, cryolite was more effective when used undiluted than in 40–50 per cent. dusts, and 2 per cent. DDT was usually superior to cryolite when applied at similar rates and intervals, but was not entirely satisfactory and caused slight plant injury in some instances; the addition of nicotine, rotenone or pyrethrins to DDT did not improve control. Further tests with dusts were carried out on cantaloupe, squash and cucumber in 1949–53. Ryania and two mixtures of rotenone, pyrethrins and a synergist were all unsatisfactory. Dusts containing 3 and 5 per cent. purified DDT proved very effective and did not damage the plants when applied at about 20–30 lb. per acre 6–7 times at approximately weekly intervals, but even better control was given by 1 per cent. parathion or lindane [almost pure γ BHC], applied 3–7 times at rates of 14–50 and 11–46 lb. per acre, respectively; 9–31 lb. 1 per cent. EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate] and 12–39 lb. 2–2·5 per cent. methyl-parathion were both very effective in tests in two years, but 20 lb. 4 per cent. malathion, tested in one year only, gave

* We are informed by Bachmann that the part of *Mitt. schweiz. ent. Ges.* containing his formal description of *Q. schneideri* [*R.A.E.*, A **42** 350], which bore the date 17th December 1952, was published on 19th December, and by the editor of *Beitr. Ent.* that the part of that journal containing Zahradník's description of *Q. mařani* [**42** 350], though dated October 1952, did not in fact appear until 20th December. *Q. schneideri* thus has priority.—*Ed.*

only fair control, and 11–15 lb. 2 per cent. methoxy-DDT (methoxychlor) and 10–14 lb. 1·5 per cent. Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] each gave poor control when applied about 6 times, also in one year only.

In general, insecticide treatments were found to be most effective when begun at the flowering stage and repeated at intervals of about 5–7 days; a minimum of six applications was usually needed for good control, the amount of insecticide varying according to plant size, but being usually about 15–25 lb. per acre.

DDT damaged cantaloupe plants in greenhouse tests, aldrin caused severe injury to cucumber during dry weather, and methyl-parathion scorched the leaves of squash when applied in the presence of dew in one test, but did not reduce the yield. In several tests, heavy infestation by Aphids followed the use of cryolite, DDT and Dilan; EPN resulted in an increase of the potato Aphid [*Macrosiphum solanifolii* (Ashm.)] on squash, but not of the melon Aphid [*Aphis gossypii* Glov.] on cucumber, and the other materials permitted no increase.

Simons (J. N.). **The Pepper Veinbanding Mosaic Virus in the Everglades Area of South Florida.**—*Phytopathology* **46** no. 1 pp. 53–57, 4 figs., 9 refs. Baltimore, Md., 1956.

A virus disease of bell peppers (*Capsicum*) believed not to have been reported previously was prevalent in the Everglades area of southern Florida in the spring of 1954, the main symptom of infection being vein-banding. Investigations on the physical properties, host range and transmission of the virus were carried out, and *Zinnia* and *Portulaca oleracea* were found to be susceptible to it, in addition to several solanaceous plants. Nightshade (*Solanum gracile*) was found to be a naturally infected weed source. *Myzus persicae* (Sulz.) and *Aphis gossypii* Glov. both transmitted the virus efficiently to healthy pepper plants in the greenhouse, but *Aphis fabae* Scop. (*rumicis*, auct.) failed to transmit it. *M. persicae* acquired the virus in feeding periods of five seconds or less. Naturally terminated feedings resulted in a higher proportion of infections than did artificially terminated ones, but differences were apparent only during the first 15 seconds of feeding time. It also transmitted the virus in feeding periods of five seconds or less, and prolonging the test feeding beyond five minutes resulted in only a slight increase in amount of transmission. Starvation for two minutes following acquisition caused a noticeable drop in infectivity, and starvation for an hour in almost complete loss of the virus, which is therefore classified as non-persistent.

Freitag (J. H.). **Beetle Transmission, Host Range, and Properties of Squash Mosaic Virus.**—*Phytopathology* **46** no. 2 pp. 73–81, 1 fig., 22 refs. Baltimore, Md., 1956.

A mosaic disease of squash is common in the coastal regions and also occurs in the interior of California, and investigations on the properties, host range and transmission of the causal virus are here recorded. Its host range included plants in several families, but it caused distinct symptoms only in cucurbits, of which 11 species proved susceptible to infection.

In tests on insect transmission, nine species of Aphids, including four that occur on squash in the field, five Cicadellids, *Anasa tristis* (Deg.) and *Lygus* sp. all failed to transmit the virus from infected to healthy squash,

but it was transmitted by adults of *Acalymma trivittata* (Mannh.) and, less readily, *Diabrotica undecimpunctata* Mannh. *A. trivittata* acquired the virus in feeding periods of five minutes after starving for three days, and acquired and transmitted it in less than ten hours. When transferred daily to healthy squash plants, infective adults of *A. trivittata* retained the virus for 17 days, and those of *D. undecimpunctata* for 20. One example of *A. trivittata* infected 9 of 28 plants in daily transfers. Fluid regurgitated by the beetles after feeding on infected plants was found to be highly infectious, which suggests that regurgitation is the most likely source of virus in transmission. The virus was recovered from the excreta, the body fluid and the crushed bodies of the beetles.

Since Doolittle's report of the transmission of the virus of cucumber mosaic by cucumber beetles [*R.A.E.*, A **9** 306] has apparently received no published confirmation, *A. trivittata* and *D. undecimpunctata* were tested as possible vectors of this virus. Adults of *A. trivittata* were allowed to feed for several days on squash plants infected with various strains of western cucumber mosaic, and were then transferred in groups of 2–10 to healthy plants, or for one day on plants infected with common cucumber mosaic, after which they were transferred in groups of 5–23 to healthy plants. No transmission resulted, and batches of 5–10 adults of *D. undecimpunctata* also failed to transmit cucumber mosaic to any of the plants on which they fed. In view of these results, Doolittle's finding requires substantiation.

Maramorosch (K.). **Semiautomatic Equipment for injecting Insects with measured Amounts of Liquids containing Viruses or toxic Substances.** —*Phytopathology* **46** no. 4 pp. 188–190, 1 fig., 12 refs. Baltimore, Md., 1956.

The apparatus described permits the semi-automatic injection of small amounts of liquid into insects under carbon-dioxide anaesthesia. It has proved useful for the injection of virus material into Cicadellids [*cf. R.A.E.*, A **45** 201, 202, 476].

Dickson (R. C.), Johnson (M. McD.), Flock (R. A.) & Laird jr. (E. F.). **Flying Aphid Populations in southern California Citrus Groves and their Relation to the Transmission of the Tristeza Virus.**—*Phytopathology* **46** no. 4 pp. 204–210, 1 graph, 7 refs. Baltimore, Md., 1956.

The following is virtually the authors' summary. Populations of flying Aphids in southern California *Citrus* groves from 1951 to 1954 were determined by trapping with sticky boards. *Aphis spiraecola* Patch made up about 85 per cent. of the catch. *A. gossypii* Glov. constituted only 3 per cent. of the catch, but the 35,000 examples of this Aphid recorded as flying to each *Citrus* tree each year in the area of the most rapid spread of the tristeza (quick decline) virus were more than enough to account for the spread of this disease [*cf. R.A.E.*, A **39** 307; **44** 330], even though the transfer of an average of 5,600 examples of *A. gossypii* was required to produce infection in experimental work. The spread of tristeza in the groves seldom exceeded the rate of two new infections each year from each diseased tree present. The tristeza virus was shown to be non-persistent in its vector and to be carried only by *A. gossypii* in this area, at least at a demonstrable level of efficiency [*cf.* **44** 330].

MARAMOROSCH (K.). **Two distinct Types of Corn Stunt Disease in Mexico.** (Abstract.)—*Phytopathology* **46** no. 4 p. 241. Baltimore, Md., 1956.

A field survey in Mexico revealed the presence of two distinct types of stunt disease of maize [*cf. R.A.E.*, A **42** 267]. The type designated as Rio Grande corresponds to the stunt previously reported from California and Texas. It was found for the first time in Mexico, in the south (Oaxaca), north (Ciudad Victoria), and east (Vera Cruz). The type designated as Mesa Central, known previously from the central plateau and Gulf coast regions, was also found on the Pacific coast. The characteristic features of the Rio Grande type are interrupted chlorotic streaks on leaves and numerous secondary shoots. In the Mesa Central type, the chlorotic spots are absent or are less conspicuous than in the Rio Grande type. The Mesa Central disease causes red to purple discoloration of the leaves and more branching at the base and more stunting than does the other type. When several commercial varieties of maize were infected by means of the vector *Dalbulus maidis* (De Long & Wolc.), the symptoms of each type were consistently reproduced, irrespective of the variety used, and *D. maidis* proved an efficient vector for both types. Whether the two types of disease are caused by strains of the same virus or by two unrelated viruses has not yet been established.

JEWELL (F. F.). **Insect Transmission of Oak Wilt.**—*Phytopathology* **46** no. 5 pp. 244–257, 18 figs., 40 refs. Baltimore, Md., 1956.

Oak wilt, which is caused by the fungus, *Endoconidiophora fagacearum*, was first found in West Virginia in 1951, when a preliminary survey revealed infected oak trees in three districts. The author records investigations on the relation of Nitidulids to the spread of the disease and on the habits of these beetles, most of which has already been noticed [*cf. R.A.E.*, A **45** 189–190]. In transmission experiments, carried out in 1953–54, in which beetles contaminated by feeding on fungus cultures were transferred to uninfected wounds on healthy trees, the fungus was transmitted to the latter by *Glischrochilus sanguinolentus* (Ol.), *Colopterus semitectus* (Say), *Carpophilus lugubris* Murr. and a mixed batch of *C. lugubris* and *G. confluentus* (Say). The fungus was isolated from the excreta of infected beetles, and aqueous suspensions of such excreta proved infective when injected into fresh tree wounds. There is an apparently symbiotic relation of long standing between the Nitidulids and two other species of fungi [*cf.* **45** 190], which they disseminate and on which they feed. *E. fagacearum* has apparently only recently become a member of this complex, and its distribution may be expected to increase unless control measures are adopted.

FREITAG (J. H.). **Western Aster Yellows Virus Infection of Squash, Pumpkin, and Cucumber.**—*Phytopathology* **46** no. 6 pp. 323–326, 1 fig., 8 refs. Baltimore, Md., 1956.

The virus of aster yellows is known to have a wide range of host-plants, and symptoms of infection by it have been observed for several years on squash and pumpkin in the Sacramento Valley of California. In experiments, males of *Macrosteles fascifrons* (Stål) reared on *Plantago major* infected with a western strain of the virus transmitted it to healthy squash, pumpkin and cucumber plants, and others that fed on field-grown squash plants suspected of being infected transmitted it to healthy *Plantago*. *Colladonus montanus* (Van D.) transmitted it from naturally infected squash

to celery, and examples of this Cicadellid taken in a field of squash were found to be naturally infected with the virus, which they transmitted to healthy squash on which they fed. The symptoms caused by the virus in cucurbits are described; the latter seem to constitute a relatively new group of host-plants to show high infection in the field, but this might be explained by the recent occurrence of environmental conditions unusually favourable to the Cicadellid vectors.

Smalley (E. B.). **The Production on Garlic by an Eriophyid Mite of Symptoms like those produced by Viruses.**—*Phytopathology* **46** no. 6 pp. 346–347, 1 fig., 1 ref. Baltimore, Md., 1956.

Symptoms resembling those sometimes caused by viruses, but differing in some respects, were observed in many plantings of garlic in California in 1954 [*cf. R.A.E.*, A **44** 388]. They were found to be associated with infestation by *Aceria tulipae* (Keifer), which was present in large numbers on affected plants. Examination of garlic bulbs from local stores showed that all were infested by this mite, which was evidently more widespread than had been realised. When uninfested young plants growing in pots were infested with *A. tulipae* from field-infested plants or stored garlic, typical symptoms developed. The almost mature bulbs were removed from the pots, disinfested and planted in the following spring. The resulting plants showed no symptoms, indicating that the condition is due to feeding by the mites and not to a virus.

Shepherd (R. J.) & Struble (F. B.). **Tobacco Ringspot Virus on Watermelon.**—*Phytopathology* **46** no. 7 pp. 358–362, 3 figs., 12 refs. Baltimore, Md., 1956.

A pimple disease of watermelons that is common in Oklahoma and is characterised by the appearance of small swellings on the surface of the fruits was found to be caused by a virus that was identified as a yellow strain of the tobacco ringspot virus. Studies on its properties and host range and of tests of transmission by means of insects are described. In the latter, the virus was transmitted from infected watermelon to one of 48 healthy plants by examples of *Melanoplus differentialis* (Thos.) that had previously fasted for 24–36 hours, so that these grasshoppers may be occasional vectors in the field, but *Aphis gossypii* Glov. failed to effect transmission.

Takeshita (R. M.). **Identity of the Oat Red-leaf Virus with the Barley Yellow-dwarf Virus.**—*Phytopathology* **46** no. 8 pp. 436–440, 25 refs. Baltimore, Md., 1956.

Red leaf is a virus disease of oats that has caused losses of yield in many parts of the United States. An Aphid-borne virus disease named yellow dwarf has recently been described from barley and other cereals there and it causes symptoms on oats similar to those of red leaf [*cf. R.A.E.*, A **43** 268]. Investigations were therefore carried out on the relation of the two diseases to one another. It was found that red leaf could not be transmitted through seed or soil or by mechanical means. In tests with Aphids, *Rhopalosiphum prunifoliae* (Fitch) and *Macrosiphum avenae* (F.) (*granarium* (Kby.)) from oats infected with red leaf in the greenhouse transmitted the virus to 12 and 16 of 20 healthy oat plants to which they were transferred in batches of 3–5,

and Aphids collected on infected oats in the field in Illinois transmitted it to oats, wheat, barley and rye, the incubation period being 2–3 weeks. Oats developed a typical reddening of the leaves, barley and wheat a moderate yellowing of the leaves and stunting, and rye a slight stunting. Virus-free Aphids of the species *R. prunifoliae*, *M. avenae*, *Aphis* (*M.*) *maidis* Fitch and *Toxoptera graminum* (Rond.), all of which have been reported to transmit yellow dwarf [*loc. cit.*], recovered the virus from oats infected with red leaf and transmitted it to oats, barley, wheat and rye, the symptoms varying somewhat according to the place of origin of the virus, and the efficiency of transmission varied from 16 to 100 per cent., depending on the Aphid used and the conditions. The red-leaf virus persisted in *M. avenae* and *R. prunifoliae* for 15 days, the maximum tested, and the yellow-leaf virus has been reported to persist in its Aphid vectors for at least five days [*loc. cit.*]. Virus isolated from barley and wheat showing yellow-dwarf symptoms appeared identical with that from oats showing red leaf, and it is concluded as a result of the work that the two described diseases are caused by one and the same virus.

Webb (R. E.). **Relation of Temperature to Transmission of the Potato Leafroll Virus.** (Abstract.)—*Phytopathology* **46** no. 8 p. 470. Baltimore, Md., 1956.

Aphids (*Myzus persicae* (Sulz.)) were reared at 22 and 27°C. [71·6 and 80·6°F.] on potato plants infected with leaf-roll virus, and adult apterae were transferred singly with a camel-hair brush to individual plants of *Physalis floridana* and allowed to feed for three days. In four separate trials, 208 indicator plants were infested at 27°C. and 217 were infested at 22°C., and the percentages that became infected were 58 at 27°C. and 26 at 22°C. When individual Aphids were transferred from the virus-infected plants at 27°C. to 114 indicator plants at 22°C., 50 per cent. of the latter became infected, and when they were transferred from the virus-infected plants at 22°C. to 105 indicator plants at 27°C., 32 per cent. of the latter became infected. In a further test, 20 potato plants of each of three varieties were infested with 15 viruliferous Aphids per plant from infected plants at 22 and at 27°C., and the numbers of plants that became infected were 11, 17 and 0, respectively, at 22°C. and 16, 20 and 18 plants at 27°C. High temperature apparently influenced the number of infective Aphids and lowered the resistance of the potato.

Lienk (S. E.) & others. **Taste Evaluation of Apples treated with the Acaricide Ovex.**—*Agric. Chem.* **11** no. 12 pp. 46–48, 117, 2 refs. Baltimore, Md., 1956.

In the experiments described, apple trees of six varieties in four localities in the United States were sprayed in 1954 with 50 per cent. wettable ovex (p-chlorophenyl p-chlorobenzene sulphonate) at 0·25 lb. per 100 U.S. gals. in the pre-bloom spray, where this was applied, and at 0·5 lb. in subsequent ones. Trees in Indiana received six applications from April, trees in Ohio and New York four from May and June, respectively, and trees in Michigan four from June or five from May, usually in alternate applications of a general spray, which included an organic fungicide and an insecticide (DDT or lead arsenate) and was applied at intervals of 10–14 days. Totals of 32–40 oz. 50 per cent. powder per acre were applied by the middle of August and the fruit was harvested between late September and mid-October. It showed residues of 0·08–1·17 parts per million ovex before

being processed into apple sauce and, with one possible exception, none after; the present tolerance of ovex residues on fresh fruits in the United States is 3 p.p.m. Processed samples of treated and untreated fruits showed differences in taste in some instances, but the results were inconsistent, and the variations found are believed to be due to factors other than treatment with ovex; no objectionable flavours were detected.

MacCollom (G. B.). **Effects and Correction of DDT Phytotoxicity to Cucumbers.**—*Mem. Cornell agric. Exp. Sta.* no. 339, 48 pp., 7 figs., 45 refs. Ithaca, N.Y., 1956.

The following is based on the author's summary. From the time of the earliest experiments with DDT, its phytotoxicity to cucurbits has been apparent [*R.A.E.*, A **34** 338; **35** 159; **37** 250, 416]. In tests begun in New York in 1951, the incorporation of activated charcoal was found very effective in reducing the injury caused by dusts [**43** 43], and field tests were made in 1952–53 to compare the effects of varying ratios of activated charcoal. In 2 per cent. DDT dusts, the addition of charcoal to technical DDT in the ratio of 3:1 and to a wettable powder formulated on ground tobacco stems in the ratio of six parts charcoal to one part actual DDT gave the best results, but there was no lessening of injury when charcoal was added to purified DDT, which is less phytotoxic than the technical product. The inclusion of activated charcoal in wettable-powder sprays failed to reduce the injury, and the use of Triton B-1956 [a modified phthalic glycerol alkyd resin] as an adhesive and spreader increased it. When soybean flour was substituted for B-1956, the effect on the plants was similar to that of DDT without additives. The 2 per cent. DDT dust with charcoal caused a significant increase in yield on four of five varieties of cucumber.

In greenhouse tests, the injury due to technical DDT was found to be primarily associated with the o,p′ and p,p′ isomers [*cf.* **43** 43], the first of these being twice as phytotoxic as the second, and in laboratory tests, the addition of activated charcoal to DDT in sprays reduced its contact toxicity to larvae of *Laphygma* (*Prodenia*) *eridania* (Cram.) and to *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)) but not its stomach action on *L. eridania*.

MacLagan (D. S.). **Effects of modern Insecticides on Growth of Plants.** —*Nature* **179** no. 4571 pp. 1197–1198, 2 graphs, 5 refs. London, 1957.

During work to determine the maximum dosage of insecticide that can be applied to seeds without subsequent phytotoxic effects, the seeds of swede, parsnip, beet, bean and mangold were observed in field tests to germinate faster after treatment than untreated seeds and to produce better plant stands, despite the apparent absence of insect attack. In further investigations, parsnip seeds treated with γ BHC at 2 or 2·5 per cent. by weight or with dieldrin at the higher dosage were germinated in sterilised compost between glass plates in the laboratory. All the dressings caused phytotoxic effects that persisted for 14 days, but there was a subsequent stimulant effect on root growth from 2 per cent. γ BHC, though not from 2·5 per cent. γ BHC or dieldrin. There was no significant difference in the mean root length of parsnip seedlings grown in experimental plots from treated and untreated seed, but treatment with 2 per cent. γ BHC quadrupled the percentage of seedlings with roots exceeding 7 ins. in length, doubled the proportion in which the root was only 4–5 ins. long and decreased the proportion with roots of intermediate lengths, and 2 per cent. dieldrin increased the proportion of roots of intermediate lengths. In similar experiments with mangold seeds treated with γ BHC, dieldrin and aldrin at 0·35

per cent. (which provided the same amount of toxicant per seed as the 2 per cent. dressing on parsnip seeds), all the materials increased mean root length in the laboratory, but whereas the action of γ BHC was initially weak and subsequently became intensified, the reverse was true of dieldrin and aldrin. In the field, γ BHC again exerted some differential effect, and there were indications of slight increase in yield depending on the proportion of seedlings that were stimulated. It is suggested that the beneficial effects on cereals of seed dressings applied against wireworms and Tipulid larvae at concentrations as low as 0·06 per cent. and not entirely attributable to insecticidal action [*cf. R.A.E.*, A **40** 216] may be due to a stimulant effect on plant growth.

Holmes (N. D.) & Farstad (C. W.). **Effects of Field Exposure on immature Stages of the Wheat Stem Sawfly, *Cephus cinctus* Nort. (Hymenoptera: Cephidae).**—*Canad. J. agric. Sci.* **36** no. 3 pp. 196–202, 1 graph, 6 refs. Ottawa, 1956.

Shallow cultivation in autumn or spring to expose wheat stubs infested by overwintering larvae of *Cephus cinctus* Nort. has been recommended for the control of this sawfly in Canada [*cf. R.A.E.*, A **29** 112; **36** 390], but since rainfall during the exposure period may nullify the effects of desiccation and some larvae may re-enter diapause if exposed to hot, dry conditions in spring [*cf.* **37** 126; **45** 55], the relation between the date and the effectiveness of exposure was investigated.

In a test of spring exposure in Saskatchewan in 1948, stubs were dug up every 2–4 days between 9th May and 4th June and on 19th June, and left on the soil. Sample stubs were split at regular intervals until 9th July, when those remaining were stored at 0°C. [32°F.] to eliminate the induced diapause in the surviving larvae. During the exposure period, the maximum daily temperature at the surface of the soil ranged from 75 to 120°F., the maximum daily air temperature ranged from 53 to 90°F. in May and from 59 to 93°F. in June, and precipitation in the two months amounted to 0·03 and 2·01 ins. Pupae were first found on 25th May, and larvae, which, with prepupae, predominated until 28th May, comprised only 3 per cent. of the population by 4th June. The date of exposure was more important than its duration. Larval survival decreased progressively from 35 per cent. after exposure on 9th May to 1 per cent. after exposure on 4th June, and mortality was over 90 per cent. in stubs first exposed between 25th May and 4th June, when most individuals were in the prepupal or pupal stages. A short period of exposure caused considerable mortality among sawflies first exposed in these stages, even though the temperature was not excessively high and there was some precipitation. Most of the larvae that survived exposure gave rise to adults, in which, however, the bodies and wings were abnormally short. Adults emerged from 17 per cent. of the stubs exposed on 19th June. A consideration of the meteorological data during the exposure period and the findings of previous investigators [**36** 391; **45** 56] indicated that temperature was the main factor operating during the first part of the exposure period, though it is not known whether that or desiccation was the major cause of mortality, and that desiccation was the major factor during 20th–26th June, although considerable rain fell during this period.

The value of autumn exposure was investigated in the same year in Alberta, where stubs were dug up and exposed on seven dates between 14th August and 29th September; samples were examined at weekly intervals until 1st October, and the rest were left on the ground until 3rd June 1949. Between 14th August and 1st October, there was no precipitation and the maximum temperature at the surface of the soil ranged from 74 to 127°F.

The percentage mortality was relatively high (60) among larvae exposed on 14th August, when a temperature of 127°F. occurred and many larvae had cut the stems but not yet formed their cocoons, but mortality in stubs exposed after that date was only 21–28 per cent. By the following June, mortality was complete or virtually so in all the plots, which included both spring- and winter-sown wheat, although weather conditions during the winter were not unusually severe and in spring were more favourable for the sawfly than they had been in Saskatchewan. It is concluded that most mortality occurred during the winter, and that excellent control can be obtained by exposure at any time during the autumn. Spring exposure should be limited to the latter part of May and early June, when most of the population is in the prepupal or pupal stage.

Read (D. C.). **An Apparatus for removing Puparia and Larvae from Soil.** —*Canad. J. agric. Sci.* **36** no. 3 pp. 205–207, 1 pl., 1 ref. Ottawa, 1956.

The following is based almost entirely on the author's abstract. An apparatus designed for the separation of root-maggot puparia from wet or dry soil is described. Infested soil is washed through two screens of different meshes placed one above the other over a water tank. Soil masses are broken up by brushes moved across the upper screen, on which large débris is retained. The lower screen is vibrated manually and retains the puparia and débris of a similar size. The puparia are then floated off in clear water and collected with a piece of screen wire; larvae can be removed from the débris with forceps. Puparia of *Hylemyia brassicae* (Bch.) added to soils of different types in batches of 100 were all removed by means of the apparatus, and adults subsequently emerged from 95 per cent. of them.

Willison (R. S.) & Dustan (G. G.). **Fruit Flies and fungal Wastage in Peaches.**—*Canad. J. agric. Sci.* **36** no. 3 pp. 233–240, 1 ref. Ottawa, 1956.

The following is based almost entirely on the authors' summary. In experiments in Ontario during 1953–55, infestation of harvested peaches by mixed batches of *Drosophila melanogaster* Mg., *D. buscki* Coq., *D. repleta* Woll. and *D. immigrans* Sturt. was found to increase both the incidence and the rate of development of brown rot (*Sclerotinia* (*Monilinia*) *fructicola*) and black mould (*Rhizopus nigricans*) on the fruits when external sources of inoculum were available. In the absence of *Drosophila*, the presence of inoculum sources within 2 ft. of baskets of test fruits had no consistent effect on the incidence of wastage. The percentages of brown-rot attacks starting at the stem end in the absence and presence of *Drosophila* were, respectively, 44 and 60 in the Veteran variety and 66 and 84 in Elberta, which is very susceptible to stem-end injuries at harvest. The incidence of brown rot was somewhat lower in fruit from trees sprayed with sulphur than from those sprayed with captan (N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide), and the sulphur also appeared to have some repellent effect on the flies. Black mould usually did not appear until the fruit was ripe, and it was carried very efficiently by *Drosophila* from outside sources of inoculum. If black-mould inoculum was present on the test fruits when picked, but not in the external source, the flies had little effect on its dissemination. Under these conditions, fruits that had been sprayed with captan were better protected than those sprayed with sulphur.

Miller (L. A.). **Insecticides and varietal Resistance in the Control of the Squash Vine Borer,** *Melittia cucurbitae* **(Harr.), in southwestern Ontario.**—*Canad. J. agric. Sci.* **36** no. 4 pp. 309–313, 6 refs. Ottawa, 1956.

The following is largely based on the author's abstract. In experiments in south-western Ontario in 1952 and 1954 with a variety of squash highly susceptible to attack by *Melittia cucurbitae* (Harr.) dusts of 2·5 per cent. aldrin, 1 or 2·5 per cent. dieldrin, 3 per cent. methoxy-DDT (methoxychlor) or 3 per cent. aerosol-grade DDT applied about the time of adult emergence [*cf. R.A.E.*, A **45** 256] each gave excellent protection against infestation. A dust of 1 per cent. rotenone with a fungicide was moderately effective. Three applications, the first during the last week of June and the others at intervals of 7–10 days, made at rates varying from 10–15 lb. per acre for the first application to 30–40 lb. per acre for the last, were adequate. The dusts should be directed to the bases of the stems, where 85 per cent. of the eggs are laid. All the materials reduced oviposition, and all also controlled the striped cucumber beetle [*Acalymma vittata* (F.)] and *Diabrotica undecimpunctata howardi* Barber. None of the dusts damaged the plants. Observations on the susceptibility to attack by *M. cucurbitae* of various species and varieties of cucurbits are recorded.

Busvine (J. R.). **A critical Review of the Techniques for testing Insecticides.**—10¼ × 7 ins., ix + 208 pp., 50 figs., 555 refs. London, Commonw. Inst. Ent., 1957. Price 30*s*.

Strains of injurious insects and other arthropods resistant to toxic materials applied against them have steadily become more numerous during the past ten years and have been reported in over 30 pests in different parts of the world. It is clear that the number of species that escape control because of resistance is increasing from year to year, and the specific and basic research necessary if this trend is to be arrested is hampered by a lack of satisfactory techniques for the precise measurement of resistance. The author therefore reviews, from the entomological and other literature published up to the spring of 1957, methods that have been devised for laboratory tests of insecticides and acaricides for the control of pests of medical, veterinary and agricultural importance. All stages of the techniques are dealt with in a comprehensive manner, and information on chemical, physical, mechanical and other factors that influence the results and methods for determining their effect are in many cases included. An introductory chapter on the choice of method for the measurement, for different purposes, of toxicity in materials applied for control and susceptibility in arthropods, is followed by two on methods of handling test arthropods and their physiological standardisation. A further two chapters are devoted to apparatus and procedure for tests of sprays and aerosols and for the injection and topical application of insecticides, six to techniques for testing the various types of toxic materials, classified according to their mode of action, and one to statistical procedure. The chapter on stomach poisons includes information on apparatus for the application of dusts and on techniques for tests of materials applied to leaves and textiles, in baits, or mixed with food or breeding media, and of systemic insecticides and acaricides applied to plants and to domestic and laboratory animals. Materials possessing contact toxicity are the subject of three chapters, of which one includes techniques for basic studies of their action and for tests of their effectiveness, one on residual action contains a review of methods for their application as films and the subsequent evaluation of their toxicity, and the third is chiefly

concerned with techniques for materials applied against mosquito larvae, but also includes some information on dipping techniques for Aphids and a few other insects of agricultural importance. Fumigants and repellents are dealt with in the remaining two chapters. In a brief conclusion, the author stresses the need for the development and general adoption of simple, but sound, techniques and the desirability of standardisation in methods for assessing resistance.

Georghiou (G. P.). **Control of "Medfly" on Apricots.**—*Countryman* Sept. 1956 p. 18. Nicosia, 1956.

The Mediterranean fruit-fly [*Ceratitis capitata* (Wied.)] is a serious pest of apricots in most areas of Cyprus. A large-scale control demonstration was organised in June–July 1956 in a district in which up to 30 per cent. or more of the late-maturing fruits are commonly infested, the method used being the same as that employed for bait-sprays on *Citrus* in 1955 [*cf. R.A.E.*, A **45** 461]. A bait-spray of 1 per cent. malathion in 10 per cent. sugar solution was applied in several orchards to a patch of foliage on each tree 2–3 times at intervals of about ten days and resulted in the total prevention of infestation, which reached 2–6 per cent. on untreated trees, the fruit-fly population being unusually low.

Hammad (S. M.). **Further Additions to the Knowledge of some Leaf-miners from Egypt (Lepidoptera and Diptera).**—*Bull. Soc. ent. Egypte* **40** pp. 21–27, 2 figs., 7 refs. Cairo, 1956.

Records are given of eight more leaf-miners observed near Alexandria [*cf. R.A.E.*, A **45** 167]; those that attacked plants of economic importance comprise *Acrocercops conflua* Meyr. on castor (*Ricinus communis*), *Lyonetia clerkella* (L.) on apple, plum, quince and rose and rarely on pear, *Tylomyza pinguis* (Fall.) on lettuce, and *Pseudonapomyza atra* (Mg.) on maize, wheat and barley. The mines and the way in which the frass is disposed in them are described and illustrated.

El-Sawaf (S. K.). **Some Factors affecting the Longevity, Oviposition, and Rate of Development in the Southern Cowpea Weevil, *Callosobruchus maculatus* F. (Coleoptera: Bruchidae).**—*Bull. Soc. ent. Egypte* **40** pp. 29–95, 1 fig., 57 refs. Cairo, 1956.

The laboratory observations here described on the effects of various factors on the bionomics of *Callosobruchus maculatus* (F.) were begun with a stock obtained from infested cowpeas from Upper Egypt in September 1951. On cowpeas, 11 generations developed between April 1952 and May 1953, and the progeny of eight females and 15 males destroyed more than half of about 2 lb. cowpeas in three months [*cf. R.A.E.*, A **29** 58, 321]. When newly emerged adults that had been reared at 25°C. [77°F.] and 75 per cent. relative humidity were kept at constant temperatures of 18–35°C. [64·4–95°F.] and relative humidities of 55–90 per cent., the mean length of life decreased from about 24 days at 18°C. to about 7 at 35°C. for females, males surviving for slightly less, and the mean number of eggs laid per female were about 50 at 18°C., 80 at 25°C. and 54·5 at 35°C. Increased relative humidity slightly increased adult life and the number of eggs laid. When the insects were reared to maturity at constant temperatures of 21, 25 and 31°C. and relative humidities of 55, 65 or 75 per cent. and were kept at 25°C. and 75 per cent. relative humidity during adult life, raising the rearing

temperature slightly decreased the survival period of the adults and reduced the number of eggs laid, but changing the humidity had no effect.

When the Bruchid was reared on other leguminous seeds, adults from soy beans had significantly shorter lives than any others, and those from *Dolichos lablab* and peas tended to have shorter lives than those from broad beans (*Vicia faba*) or chick-peas (*Cicer arietinum*). The mean number of eggs laid per female was greatest (75) for those reared on *C. arietinum* and least on soy bean. On cowpeas, more eggs were laid on sound than on broken seeds, and unfertilised females laid very few eggs, none of which hatched. The development of the immature stages was also dependent on temperature, the mean durations of the egg stage and the combined larval and pupal stages falling from 20·7 and 119·2 days at 18°C. to 3·7 and 15·3 days at 35°C., but varied little with relative humidities of 55–90 per cent. The percentage of adult emergence increased with rising temperature, and was little affected by relative humidity unless this was high enough to favour the growth of fungi. Males were slightly more numerous than females under all conditions, and the reproductive rate was greater when 16 pairs of adults were confined with 90 cowpea seeds than at higher or lower population densities.

Habib (A.). **The Male** *Eulecanium corni* **Bouché (Hemiptera-Homoptera: Coccoidea-Coccidae).**—*Bull. Soc. ent. Egypte* **40** pp. 119–126, 5 figs., 9 refs. Cairo, 1956. *Eulecanium taxi* **nov. spec. (Homoptera: Coccoidea-Coccidae).**—*T. c.* pp. 453–462, 6 figs., 10 refs.

In the second of these papers, the author describes all stages of *Eulecanium taxi*, sp.n., from yew (*Taxus baccata*) in southern England [*cf. R.A.E.*, A **45** 164], and gives characters distinguishing it from the other species of the genus, especially *E. corni* (Bch.). Observations on its bionomics [*cf. loc. cit.*] showed that the females laid 152–543 eggs each, beginning about mid-May. The crawlers hatched in June and migrated to the tips of the twigs, where they fed on both surfaces of the leaves. They congregated on the undersides of the leaves, leaf-stems and twigs within 1–2 weeks and moulted about mid-August, after which there was little movement, and again in April. The males, which comprised about 2 per cent. of the population, pupated towards the end of April and emerged in the first half of May, and the females reached full size a few days after the second moult.

In the first paper, the author points out that the males from *T. baccata* described by Gimingham [**22** 173] were in reality *E. taxi* and states that he found males of *E. corni* in southern England only on *Cotoneaster microphylla*. The puparium, prepupa, pupa and adult male are described. Males comprised not more than 5 per cent. of the population; the second-stage nymphs formed puparia from the beginning of April and transformed to adults in late April or early May. In the laboratory, males of *E. corni* developed on plants other than *Cotoneaster*; fertilised females produced young of both sexes and unfertilised ones females only. Attempts to mate males of either species with females of the other were unsuccessful.

Soliman (A. A.). **On the Control of the Olive-tree Scale,** *Leucaspis riccae* **Targ., at Burg El-Arab, Egypt (Hemiptera: Coccoidea).**—*Bull. Soc. ent. Egypte* **40** pp. 207–215, 1 fig., 11 refs. Cairo, 1956.

Olive trees have been successfully introduced into the desert area of Burg El-Arab, about 30 miles west of Alexandria, but are severely attacked

by *Leucodiaspis* (*Leucaspis*) *riccae* (Targ.), which has one generation a year there. The recommended spray of 1·75 per cent. oil emulsion afforded poor control, and the author describes experiments in which sprays of parathion and Tetrax [a preparation containing schradan] were compared with it. Parathion proved the most toxic and did not damage the trees. One application at 0·08 per cent. was more effective than one at 0·01–0·04 per cent., but less so than two at 0·04 per cent., which gave 90 per cent. kill. Applications are best made in April–June, when the crawlers appear, and 2–3 at a concentration of 0·04 per cent. are recommended. Tetrax gave fair control and was superior to oil emulsion.

Hafez (M.) & Osman (F. H.). **Biological Studies on** *Bruchidius trifolii* **(Motsch.) and** *Bruchidius alfierii* **Pic, in Egypt (Coleoptera: Bruchidae).** —*Bull. Soc. ent. Egypte* **40** pp. 231–277, 37 figs., 58 refs. Cairo, 1956.

The authors record investigations in Egypt confirming that *Bruchidius alfierii* (Pic) is a form of *B. trifolii* (Motsch.) [*cf. R.A.E.*, A **44** 299] and describe observations on the bionomics of these Bruchids, which infest the seeds of Egyptian clover (*Trifolium alexandrinum*). The following is based on their summary of the work. Adults of the typical *B. trifolii*, which have black legs and antennae, are found throughout the year, hibernating under fallen leaves or other shelter in the field and becoming active in spring and early summer, when the new crop is infested. Those of the next generation aestivate in small numbers in stored seeds, appear in numbers at the beginning of October and overwinter. Attempts to breed this form in the laboratory were unsuccessful, as the females did not reach sexual maturity. The other form, which has reddish legs and antennae, has 4–5 generations a year, the adults being abundant in the field in May and June and in store-houses from June to September. Breeding of this form resulted in progeny of both forms and also in intermediates that resembled their parents in type of sexual development and other life processes and paired with others of the intermediate or reddish forms. A female of this form produced males and females of the same form after pairing with a male of the other.

Laboratory observations on the reddish form showed that at 32°C. [89·6°F.] and 50 per cent. relative humidity, the egg stage lasted 5·1 days and the combined larval and pupal stages 15·5 days, adult males and females lived for 8·7 and 3·7 days, respectively, the preoviposition period was 3–4 hours, and the average total number of eggs per fertilised female was about 52. Adults that did not pair lived longer than those that did, but the eggs laid by unfertilised females did not hatch. Length of life and fecundity were both increased when food, such as honey or sugar solution, was provided for the beetles. The eggs were deposited on the seeds of *T. alexandrinum*, preferably on sound ones, the presence of which stimulated oviposition. The larvae bored into the seeds immediately after hatching, passed through four instars and pupated inside the seeds. Temperature and humidity had little or no effect on the preoviposition period or number of eggs, but the egg and larval stages and adult life were all longer at lower temperatures. Females were slightly more numerous than males.

Hassan (A. S.) & Zaher (M. A.). **Biology of the Red Spider Mite,** *Eotetranychus cucurbitacearum* **Sayed (Acarina: Tetranychidae).**—*Bull. Soc. ent. Egypte* **40** pp. 301–320, 8 figs., 20 refs. Cairo, 1956.

Tetranychus telarius (L.) (*Eotetranychus cucurbitacearum* Sayed) is a serious pest of many economic plants in Egypt [*cf. R.A.E.*, A **36** 411], and

its life-history was studied on potted plants of bean (*Phaseolus vulgaris*) under natural climatic conditions there in 1951–52. It was found that 27 generations developed in the year, fertilised females producing about 18·7–25·4 per cent. male progeny and unfertilised ones males only. Females and males from unfertilised females passed through two nymphal stages, whereas males from fertilised females passed through either one or two [*cf.* **44** 417]. The duration of development was dependent on temperature, and the time required for the completion of a generation ranged from 8·5 days in summer to 43·3 days in winter. Eggs exposed to direct sunlight in summer took a day longer to hatch than those in the shade. The average number of eggs laid per female varied from 79·2 to 151·4, being greatest in autumn. The immature stages of the mite are described, and it is stated that *Scolothrips longicornis* Priesn. and *Orius laevigatus* (Fieb.) afford important control of it.

Abul-Nasr (S.). **Polyhedrosis-virus Disease on Cotton Leaf-worm,** *Prodenia litura* **F.**—*Bull. Soc. ent. Egypte* **40** pp. 321–332, 6 figs., 11 refs. Cairo, 1956.

Larvae of *Prodenia litura* (F.) in Egypt are attacked by a polyhedral virus disease that sometimes causes high field mortality. Laboratory tests, in which larvae were infected by feeding them on leaves of berseem [*Trifolium alexandrinum*] dipped in suspensions of the polyhedra, and kept at temperatures ranging from 13–16°C. [55·4–60·8°F.] in winter to 28–32°C. [82·4–89·6°F.] in summer, showed that the disease developed rapidly in summer and slowly in winter, larvae usually dying 4–5 days after feeding in summer and showing full symptoms only after 10–12 days, if at all, in winter. High relative humidity increased the virulence of the disease and reduced the incubation period. Suspensions of 5–10 million polyhedra per ml. were sufficient to infect larvae in the third or later instars, but concentrations of 50–100 million per ml. were necessary to infect those in the first instar and 25–50 million for those in the second. Field-collected larvae that were reared singly under sterilised conditions in the laboratory showed that natural infection reached 5 per cent. on berseem in spring, 10–20 per cent. on cotton in summer and over 25 per cent. on maize in late summer, when the high temperature and humidity and the heavy larval populations favoured the disease. The symptoms of the disease and its effects on the internal tissues of the larvae are described.

Ezzat (Y. M.). **Studies on the "Kew Bug",** *Orthezia insignis* **Browne (Coccoidea-Ortheziidae).**—*Bull. Soc. ent. Egypte* **40** pp. 415–431, 15 graphs, 1 map, 23 refs. Cairo, 1956.

Orthezia insignis Browne, which has been found on hedges of *Clerodendron inerme*, *Lantana camara*, *Bignonia* and *Ipomoea palmata* in Alexandria, is considered to be a potential pest of many important crops in Egypt, particularly in the north of the Nile Delta, and investigations on its bionomics and control were therefore carried out. All stages are present throughout the year, and laboratory observations of insects kept on sprouting potato tubers indicated that the limiting temperatures were about 14°C. [57·2°F.] (for the adult females) and 34°C. [93·2°F.] (for the eggs). The effects of temperature on the duration of the egg stage, the three nymphal instars, the complete nymphal stage, the preoviposition and oviposition periods and the number of eggs laid are shown on graphs. There was about 10 per cent. mortality in the egg stage and 40 per cent. in the nymphal stage, and most

eggs were laid when the temperature was 17°C. [62·6°F.]. There appeared to be about three generations a year, but they overlap because of the long oviposition period, which varied from some 20 days at about 30°C. [86°F.] to 120 days at 17°C.

In tests on control, proprietary mineral-oil emulsions gave about 90 per cent. or more kill, and a 5 per cent. parathion dust about 40 per cent. Two applications of 4 per cent. mineral oil at an interval of five weeks are recommended. Fumigation for 20–90 minutes with hydrogen cyanide generated from 10 g. sodium cyanide, 20 cc. sulphuric acid and 30 cc. water gave complete mortality of all stages, including eggs, in a fumigation chamber with a capacity of 40 cu. ft., and this treatment is recommended for use in greenhouses.

Attiah (H. H.). **The Genus *Brevipalpus* in Egypt (Acarina: Tenuipalpidae).** —*Bull. Soc. ent. Egypte* **40** pp. 433–448, 45 figs., 13 refs. Cairo, 1956.

The author gives keys to the adult females and the nymphs of the Egyptian species of *Brevipalpus* and describes the male, female and nymph of *B. lanceolatisetae*, sp. n., from prune, apricot, pear and apple in Lower and Upper Egypt. He also redescribes the male, female and nymph of *B. geisenheyneri* (Rübs.) (*pyri* Sayed) [*cf. R.A.E.*, A **36** 412], and the female and nymph of *B. inornatus* (Banks), which attacks pear, quince, some ornamental plants and weeds, and *B. phoenicis* (Geijskes), which infests pear, quince, vines and ornamental plants, and gives descriptive notes on various stages of *B. australis* (Tucker), which was formerly misidentified as *Tenuipalpus obovatus* Donn. [*cf.* **31** 441] and infests *Citrus*, guava, plum, apricot, vines and ornamental plants, *B. olearius* Sayed on olive and *B. lewisi* McG. on vines. No males of *B. inornatus*, *B. phoenicis* or *B. lewisi* have been observed in Egypt.

Fahmy (I.). **The economic Importance of Mites affecting Fruit Trees, with special Reference to *Citrus*, in Egypt (Acarina).**—*Bull. Soc. ent. Egypte* **40** pp. 449–450, 6 refs. Cairo, 1956.

Severe damage is caused by mites to fruit trees, especially *Citrus*, in Egypt. *Metatetranychus ulmi* (Koch) (*Paratetranychus pilosus* (C. & F.)) has recently been observed on pear in Gharbieh Province, and *Aceria mangiferae* Sayed is very injurious to mango. Damage resembling that caused by *Aceria sheldoni* (Ewing) has recently been noticed on sweet lime and lemon.

Hassanein (M. H.). **Nocturnal Activity of Insects as indicated by Light-traps.**—*Bull. Soc. ent. Egypte* **40** pp. 463–479, 2 figs., 37 refs. Cairo, 1956.

The following is taken largely from the author's summary. Investigations on the nocturnal activity, abundance and population density of insects in the field at Shebin El-Kom (Menoufieh), Egypt, were made by means of two light-traps operated almost every night in 1952 and with four in 1953, the source of light being a 200-watt lamp. The average catch was highest in July and lowest in January. Diptera and Homoptera comprised about 78·5 and 14·9 per cent., respectively, of the total catch, and Lepidoptera and Coleoptera about 2·8 and 2·2 per cent. Special attention was devoted to Lepidoptera of economic importance. *Prodenia litura* (F.), the main pest of cotton and clover [*Trifolium alexandrinum*] in Egypt, was taken in all months and was most abundant in June and July. There appeared to be

five overlapping generations a year, and females comprised 47·25 per cent. of the total. *Laphygma exigua* (Hb.) was taken from March to December; it had six generations a year, and males and females occurred in almost equal numbers. Four generations of *Agrotis ypsilon* (Hfn.) developed between late September and mid-July, and its absence in August confirmed earlier findings of its migratory habit; numbers were greatest in April, and 52·5 per cent. of the adults were females. *A. spinifera* (Hb.) was present throughout the year and was caught in large numbers from spring to autumn, 45·9 per cent. of the catch being females, and *Earias insulana* (Boisd.) reached a peak of activity in September and October, males being three times as numerous as females. Several species appeared to have two generations a year. Of these, *Autographa* (*Phytometra*) *gamma* (L.) was unusually abundant in March and April, and records of mass flights at this time indicate that it is migratory in Egypt; females and males were about equal in numbers in this species and in *Heliothis armigera* (Hb.) (*Chloridea obsoleta*, auct.). The ratio of males to females was 3:2 for *Chilo suppressalis* (Wlk.) (*simplex* (Btlr.)), which was most active in October, and *A.* (*Syngrapha*) *circumflexa* (L.), and 4:1 for *Pyrausta nubilalis* (Hb.), which was abundant during September and October.

Descamps (M.). **Contribution à l'étude des diptères Diopsidae nuisibles au riz dans le Nord-Cameroun.**—*J. Agric. trop. Bot. appl.* **4** no. 1–2 pp. 83–93, 4 figs. Paris, 1957.

The cultivation of rice is increasing in the North Cameroons, particularly in the Logone valley, but the yield is severely reduced by insect pests. The stems are mined by Lepidoptera, including *Proceras africanus* (Auriv.), and by Diptera, including *Pachydiplosis oryzae* (Wood-Mason) and various Diopsids. Investigations were carried out on the habits of 15 species of this last group, of which seven, *Diopsis thoracica* Westw., *D. collaris* Westw., *D. ichneumonea* L., *D. servillei* Macq., *D. tenuipes* Westw., *D. circularis* Macq., and *D. curva* Bertolini, are injurious to rice and other cultivated graminaceous plants. Of these, the first five occur in rice-fields in low-lying or flood areas, and the last two in the savannah. The females lay 30–60 eggs each, generally singly and on the subterminal leaves of healthy plants, but the eggs of *D. tenuipes* are laid in small groups indifferently on healthy plants and those already infested. The egg, larval and pupal stages last 1–3, 6–33 and 6–12 days, respectively, according to species. Larvae of *D. thoracica* feed only on healthy plant tissues, and those of *D. collaris*, *D. servillei*, *D. circularis*, *D. curva*, and *D. ichneumonea* on healthy tissues during the first few days and then on decomposing material, whereas those of *D. tenuipes* and *D. fumipennis* Westw. feed mainly on decomposing tissues but occasionally attack healthy ones and are even predacious on other insects. Other species of the family are entirely saprophagous. The number of generations a year ranges from two for *D. thoracica*, which remains in diapause for seven months, to eight for *D. servillei*. *D. thoracica* is the principal pest of rice. The larvae enter the stems close to the ligules, bore downwards for several inches and cause yellowing of the terminal leaves. When decomposition sets in, they migrate to other plants, and in this way the larvae destroyed an average of three stalks each in rearing experiments. Pupation occurs in the leaf-sheaths of still other plants. The other species complete their development in a single plant, not more than one larva occurring per stem. General descriptions are given of the eggs, larvae, and pupae of *Diopsis* spp. together with a list of wild grasses attacked by them. Some control is afforded by predators, and considerably more by insect parasites [*cf.* next abstract], lists of which are given.

Risbec (J.). **Les parasites des insectes borers du riz au Cameroun.**—*Agron. trop.* **11** no. 2 pp. 234–247, 3 figs. Nogent-sur-Marne, 1956. (With Summaries in English and Spanish.)

A list is given of the parasites and hyperparasites reared by Descamps in 1955 from Diptera or Lepidoptera boring in the stems of rice in the French Cameroons [*cf.* preceding abstract]. The new species described, from adults of both sexes unless otherwise stated, comprise *Bruchobius yagouae* and *B. garouae*, from larvae of *Adelpherupa* sp.; *Diourbelia diopsisi*, from pupae of *Diopsis servillei* Macq.; *Anisopteromalus* (*Aplastomorpha*) *camerunus*, from larvae of *Pachydiplosis oryzae* (Wood-Mason); and *Aprostocetus* (*Tetrastichus*) *pachylophusae* (female only) and *T.* (*Epomphaloides*) *dipterae*, from pupae of a species of *Pachylophus* near *P. lugens* Lw. The other primary parasites reared include the Chalcids, *Dirhinus garouae* Risbec, from pupae of *Diopsis collaris* Westw., and *Hyperchalcidia soudanensis* Steffan, from *Proceras africanus* (Auriv.); the Eulophids, *T. pachydiplosisae* Risbec, *T. sesamiae* Risbec and *A.* (*T.*) *brevistylus* Masi, from pupae of *Pachydiplosis oryzae*, *D. servillei* and *D. thoracica* Westw., respectively, and *A.* (*T.*) *diopsisi* Risbec, from *D. servillei*, *D. collaris*, and *D. ichneumonea* L.; the Eurytomids, *Eurytoma diopsisi* Risbec, from pupae of *D. collaris*, and *E. lepidopterae* Risbec, from larvae of *Saluria* sp. and *Adelpherupa* sp.; the Eupelmid, *Eupelmella pedatoria* Ferrière, from a pupa of *D. thoracica*; *Trichogramma* (*Xanthoatomus*) *ethiopicus* (Risbec), from eggs of *Diacrisia scortilla* (Wllgr.), *Diopsis*, *Lema* sp. and undetermined Lepidoptera; the Diapriids, *Psilus* (*Galesus*) *silvestrii* (Kieff.) and *Trichopria oriphila* Kieff., from pupae of *D. collaris* and *D. tenuipes* Westw.; *Platygaster diplosisae* Risbec, from larvae of *Pachydiplosis oryzae*; and the Braconids, *Apanteles ruficrus* (Hal.), from *Proceras africanus*, *Bracon quadratinotatus* var. *sesamiae* Risbec, from *Sesamia* sp., *B. antennatus* Granger, from larvae of *Diopsis curva* Bertoloni and *Opius annulicornis* Granger, from pupae of *D. tenuipes*, and *Diopsis* sp. Notes on the morphology of some of these are given. The hyperparasites include *Melittobia diopsisephila* Risbec, found parasitising *Mepachymerus* (*Stelocerus*) *baculus* Speiser (*lepidopus* (Becker)), which is a parasite of *D. thoracica*, and a new variety of *Neanastatus tenuis* Ferrière, described as var. *platygasteri*, n., from a single female reared from *Platygaster diplosisae*.

Fernando (H. E.) & Manickavasagar (P.). **Economic Damage and Control of the Cacao Capsid, *Helopeltis* sp. (fam. Capsidae, ord. Hemiptera) in Ceylon.**—*Trop. Agriculturist* **112** no. 1 pp. 25–36, 4 figs., 13 refs. Peradeniya, 1956.

Cacao in Ceylon is attacked by a species of *Helopeltis* [recently described as *H. ceylonensis* De Silva (*R.A.E.*, A **45** 417)]. It feeds mainly on the pods, but also on young stems and shoots or leaves, and circular areas of "water-soaked" necrotic tissue appear round the feeding sites. Loss of growth and of crop results. Satisfactory control was afforded by sprays of DDT applied by knapsack sprayers equipped with lances and DDT or dieldrin applied by a mist blower, but the operation was time-consuming and reinfestation occurred after about a month. Dusts were therefore tested. They were applied in August 1955, at the peak of attack, at about 10 lb. per acre by means of a power duster, and population counts were made before and 24 hours afterwards. These showed that the mortality percentages were 71·66 for 2·5 per cent. aldrin, 86·56 for 5 per cent. DDT, 89·06 for 0·65 per cent. γ BHC, 99·53 for 1 per cent. dieldrin, and 100 for 1·5 per cent. endrin or 1·3 per cent. γ BHC. Except on the trees dusted with aldrin, reinfestation did not occur for 2–2·5 months, and the period

of protection would probably be longer if larger areas were treated. The attack on untreated trees continued undiminished.

Grylls (N. E.) & Butler (F. C.). **An Aphid transmitted Virus affecting Subterranean Clover.**—*J. Aust. Inst. agric. Sci.* **22** no. 1 pp. 73–74, 4 refs. Sydney, 1956.

A virus disease that affected subterranean clover [*Trifolium subterraneum*] in autumn and early winter and was widespread in New South Wales and, apparently, also occurred in Tasmania, Victoria and Queensland was reported in June 1955. The symptoms, which were variable, comprised stunting of the plants and marginal chlorosis and puckering of the leaflets and resembled those due to mineral deficiency and little-leaf disease [see next abstract] in its early stages. In preliminary glasshouse tests on transmission, none occurred through the seed or as a result of mechanical inoculation, and *Austroagallia torrida* Evans, *Orosius argentatus* (Evans) and *Eurinoscopus punctatus* Evans all failed to transmit the virus, though the last caused marginal yellowing and cupping of the leaflets, but when apterae of *Aphis craccivora* Koch from a colony established on an infected plant were starved for about four hours and then allowed to feed in pairs on healthy seedlings for about an hour, 20 per cent. of the latter became infected, the symptoms developing in 12–21 days. *Myzus persicae* (Sulz.) also transmitted the virus, though less efficiently.

Hutton (E. M.) & Grylls (N. E.). **Legume "Little Leaf", a Virus Disease of subtropical Pasture Species.**—*Aust. J. agric. Res.* 7 no. 2 pp. 85–97, 1 pl., 12 refs. Melbourne, 1956.

Some 40 per cent. of a comprehensive range of species and strains of leguminous pasture plants from different parts of the world grown in experimental plots near Brisbane became infected to varying degrees with a virus disease designated little leaf. This disease also occurs elsewhere in Queensland, and a plot of *Desmodium uncinatum* isolated in a forest reserve became infected with it in 1954 within four months of seeding. The symptoms comprise chlorosis and puckering of the leaves, the production of green distorted buds on plants in flower and of small, rounded, light green leaves from the terminal buds of infected shoots, and a proliferation of spindly, axillary shoots, and they resemble those caused by the virus complex that includes big-bud of tomato, witches' broom of lucerne and potato purple top [*cf. R.A.E.*, A **41** 404; **43** 77], of which it is probably another strain. Infected annual plants died prematurely, and perennials in two or more seasons. In laboratory tests, the virus was transmitted by adults of *Orosius argentatus* (Evans) collected from the plots and by their reinfected progeny, but not by a strain reared in the laboratory at Canberra, although the latter effected some transmission of other viruses of the complex. Most of the species and strains of *Crotalaria*, *Desmodium*, *Indigofera* and *Stylosanthes* were susceptible to the disease, but lucerne, clovers and many plants of potential value in pastures were resistant to it.

Walker (A. J. K.). **Malathion has important Advantages in the Control of Lucerne Flea and Red-legged Earth Mite.**—*J. Dep. Agric. S. Aust.* **59** no. 10 pp. 386–388. Adelaide, 1956.

Since experiments in Western Australia showed that malathion is as effective as parathion against the lucerne flea [*Sminthurus viridis* (L.)] on pastures and, unlike parathion, also affords some control of the red-legged

earth mite [*Halotydeus destructor* (Tucker)] [*cf. R.A.E.*, A **43** 411], recommendations are made for the use of this material in sprays on pastures in South Australia. Treatment affording 1 fl. oz. 50 per cent. malathion emulsion concentrate per acre is effective against *S. viridis* alone, but where *H. destructor* is also present, the addition of 4 fl.oz. per acre of a 25 per cent. DDT concentrate is necessary.

Smith (W. A.) & Saunders (G. W.). **Tomato Mite Control.**—*Qd J. agric. Sci.* **13** no. 1 pp. 63–65, 9 refs; also as *Bull. Div. Pl. Ind. Dep. Agric. Qd* no. 90, 3 pp., 9 refs. Brisbane, 1956.

Vasates lycopersici (Massee) is common on tomato in Queensland and also feeds on potato, Cape gooseberry (*Physalis peruviana*), *P. minima* and *Solanum nigrum* there; a major pest of tobacco in an area of south-eastern Queensland was determined in 1955 as an unidentified but closely related species. In field tests on control begun on 18th September 1951, tomato plants were sprayed weekly or fortnightly with 0·02 per cent. parathion to give 1·6–4·8 oz. toxicant per acre, according to plant size, or fortnightly with 0·01 per cent. parathion to give 0·8–2·4 oz. or with sulphur at 3·75–12·25 lb. per acre; some were treated in alternate weeks with the sulphur spray and a dust affording 5–15 lb. sulphur per acre, and all plants also received fortnightly sprays of 0·1 per cent. DDT and 0·25 per cent. copper oxychloride. On 13th November, the mite population per plant was assessed by a sampling technique that is described, and it was found that all the treatments caused significant reductions; parathion was significantly superior to sulphur in the spray, but not to the combined treatment. In further trials in 1954, treatments were applied from 14th July until a week before the final harvest, in October, and the method of counting the mites was improved. Highly significant reductions in population were given by weekly or fortnightly sprays of 0·015 per cent. parathion, fortnightly sprays of lime-sulphur (0·22 per cent. polysulphides) or treatment in alternate weeks with 0·15 per cent. wettable sulphur and sulphur dust, but infestation was late in developing and none of the treatments increased the yield. In comparison with parathion, Aramite (2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methyl-ethyl sulphite), Ovotran (p-chlorophenyl p-chlorobenzenesulphonate), Chlorparacide (p-chlorobenzyl p-chlorophenyl sulphide), Elimite (p-chlorophenyl benzenesulphonate) and Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)] were of no value. In view of local field conditions, sulphur was recommended for use on tomatos and parathion for tobacco.

Forte (P. N.) & Greaves (T.). **The Effectiveness of Dieldrin for the Control of the Argentine Ant in Western Australia.**—*J. Dep. Agric. W. Aust.* (3) **5** no. 1 pp. 85–88, 91–92, 95–96, 6 figs., 1 ref. Perth, W.A., 1956.

Further observations were made in November 1953 round blocks of houses near Perth, Western Australia, where sprays of 2 per cent. chlordane, aldrin and dieldrin had been applied in late 1951 for the control of *Iridomyrmex humilis* (Mayr) [*cf. R.A.E.*, A **42** 347]; buffer sprays of 2 per cent. chlordane to prevent reinfestation or migration between plots had last been applied in February 1952. It was found that neither chlordane nor aldrin had completely eradicated *I. humilis* or native ants. There were nests of native ants, but not of *I. humilis*, in the plot treated with dieldrin, and examples of *I. humilis* seen on the day of examination were all dead the following morning. In May 1955, dieldrin was still preventing establishment of *I. humilis* and killing examples entering the treated area.

In a further test, sprays of dieldrin and aldrin at 0·5 and 1 per cent. and chlordane and DDT at 2 per cent. were applied in March 1953 round blocks of houses at rates varying from 42 to 52 gals. per acre according to the amount of vegetation present. Buffer areas were sprayed with 2 per cent. chlordane. Aldrin at both concentrations caused marked reductions in numbers within a week, but there was an increase 46 weeks later. Dieldrin at 1 per cent. eradicated *I. humilis* within nine weeks and ants that established a trail 46 weeks after treatment died within two days. Chlordane and 0·5 per cent. dieldrin eradicated the ants in 29 weeks, but did not prevent reinfestation, though, in the case of dieldrin, this occurred only where the ground had been considerably disturbed after treatment. DDT was not effective.

The minimum concentration of dieldrin necessary for eradication was investigated in 1954. The four concentrations tested ranged from 0·125 to 0·5 per cent., and applications were made between 26th January and 3rd February at 60–70 gals. per acre. Concentrations of 0·5 and 0·375 per cent. resulted in complete eradication in about 39 weeks, 0·25 per cent. gave excellent control for 62 weeks, when the last examination was made, and 0·125 per cent. caused a reduction for 39 weeks. It is concluded that, since successful eradication depends on the skill of the operator as well as on the insecticide, a concentration of 0·5 per cent. should be used.

Jenkins (C. F. H.). **Codling Moth in Western Australia.**—*J. Dep. Agric. W. Aust.* (3) **5** no. 6 pp. 693–696, 5 figs. (4 col.), 2 refs. Perth, W.A., 1956.

Cydia pomonella (L.), the bionomics and control of which are reviewed, was found infesting apple at Bridgetown, Western Australia, in March 1956. Between 1903 and 1951, 16 outbreaks of the moth occurred at various places in this State [*cf. R.A.E.*, A **36** 106], but it was eradicated on each occasion.

Clark (P. J.) & Jacks (H.). **The Schradan Content of Fruit and Vegetables.**—*N.Z. J. Sci. Tech.* **38** (B) no. 1 pp. 58–65, 6 refs. Wellington, N.Z., 1956.

The schradan content of crops treated with this insecticide was investigated in New Zealand; the schradan was usually applied in sprays, but it was also watered on soil in which swedes were growing and used as a dip in which seed potato tubers were soaked. Schradan was detected in the swedes and in all the sprayed crops, which comprised swedes, potatoes, peas, beans, cabbages, carrots, strawberries and apples, the amount present increasing as the interval between the final treatment and harvest became shorter. In potatoes, the schradan was unequally distributed between individual tubers on the same root, and storage after harvesting did not reduce the amount present in them or in swedes; it was detected in tubers produced by plants grown from the soaked tubers. In the absence of an approved tolerance and in view of the amounts found, it is considered inadvisable to apply schradan to edible crops.

Jacks (H.). **A Note on Control of Clover Mite** (*Braeobia praetiosa* **Koch**) **on** *Dianthus chinensis* **L.**—*N.Z. J. Sci. Tech.* **37** (A) no. 6 pp. 523–525, 1 ref. Wellington, N.Z., 1956.

The results are given of glasshouse tests with sprays of 12 acaricides, mostly in proprietary form, for the control of *Bryobia praetiosa* Koch, the

methods used being similar to those in investigations with another mite [*R.A.E.*, A **44** 335]. Of the contact poisons, those that gave satisfactory immediate control, with their effective percentage concentrations, were Aramite (15 per cent. 2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite) (0·05), Murphy Tepp (40 per cent. tetraethyl pyrophosphate) (0·05), malathion (0·25), and Murphos 20 (20 per cent. parathion) (0·05). Materials that were less effective immediately but showed effective residual action were Chlorocide (20 per cent. p-chlorobenzyl p-chlorophenyl sulphide) (0·25), Murvesco (50 per cent. p-chlorophenyl benzenesulphonate) (0·1), and Ovamite (50 per cent. p-chlorophenyl p-chlorobenzenesulphonate) (0·05), which was inferior to Chlorocide. Both immediate and residual action were shown by summer oil emulsion (1·5), Systox (50 per cent. demeton [diethyl 2-(ethylthio)ethyl phosphorothioate]) (0·05) and Hanane (50 per cent. dimefox [bis(dimethylamino) fluorophosphine oxide]) (0·05). Shell Supona DPS (35 per cent. diphenyl sulphone) and Tetrax (70 per cent. schradan) significantly reduced the population, but were inferior to the other materials.

Rivera (C. T.). **Three organic Insecticides in the Control of Insects affecting upland Rice.**—*Philipp. Agric.* **39** no. 8 pp. 465–472, 1 ref. College, Laguna, 1956.

Calora (F. B.). **Three Insecticides in the Control of Insects affecting lowland Rice.**—*T. c.* no. 9 pp. 520–527, 7 refs.

In these two papers, the results are given of experiments with emulsion concentrates of parathion, TEPP [tetraethyl pyrophosphate] and toxaphene for the control of *Schoenobius incertulas* (Wlk.), *Cnaphalocrocis medinalis* (Gn.) and *Leptocorisa acuta* (Thnb.) on rice in the Philippines.

The tests described in the first paper were carried out on upland rice from April 1954 to January 1955. Sprays of 9·5 cc. 20 per cent. TEPP, 4 cc. 46·7 per cent. parathion and 3·2 cc. 60 per cent. toxaphene per U.S. gal. water, applied at about 120 U.S. gals. per acre six times at intervals of a week from 7th August, when the plants were two months old, reduced the mean percentage of leaves damaged by *C. medinalis* from 21·2 to 7·4, 7·2 and 12·5, respectively, and the same sprays applied three times at intervals of two weeks reduced it to 14·3, 13 and 15·3. The corresponding percentages of stems damaged by *S. incertulas* were 26 on untreated plants, and 5·3, 2·9 and 14·6 for six applications and 11·6, 10·2 and 17 for three on treated ones, and the percentages of panicles free from damage by *L. acuta* were 32 for no treatment, 67·1, 63 and 48·7 for six applications and 51·1, 46·7 and 42 for three. All treatments gave significant control, without damaging the plants, and six applications of TEPP and parathion, but not of toxaphene, were better than three against each insect. In comparison with no treatment, yields were 12·06, 12·94 and 2·8 per cent. greater after six applications and 5·26, 0·39 and 0·07 per cent. greater after three. In laboratory tests in which adults of *L. acuta* and larvae of *C. medinalis* were caged on sprayed plants and larvae of *S. incertulas* placed on tillers 24 hours before the plants were sprayed, TEPP, parathion and toxaphene at the same concentrations as before gave complete mortality of *L. acuta* in 12, 24 and 96 hours, respectively, of *C. medinalis* in 48, 24 and 96 hours, and of *S. incertulas* in 48, 72 and 120 hours, whereas no insects died on untreated rice. All insects fed on the treated plants.

The tests described in the second paper were made on lowland rice between December 1953 and January 1955. In the field, the sprays were applied at the same concentrations and intervals from 60 days after transplanting, the plots being drained before spraying and flooded to a depth of 2–4 ins. after it. Six applications of TEPP, parathion and toxaphene reduced the

percentage of leaves damaged by *C. medinalis* from 14 to 4·2, 3·3 and 4·7, respectively; three reduced it to 7, 6·8 and 7·5, and all reductions were significant. The corresponding reductions in the percentage of stems damaged by *S. incertulas* were from 19·3 to 7·3, 1·4 and 1 for six applications and 12·3, 7·7 and 2·5 for three, all reductions but that following three applications of TEPP being significant. Only parathion gave significantly better results against either insect when applied six times. All treatments were followed by reductions in the percentage of panicles injured by *L. acuta* and increases in yield, but none of the differences was significant. There was no insecticide damage to the plants at the time of application, but the leaves of treated plants yellowed more rapidly than those of untreated ones when the rice was in the late dough stage. In the laboratory, parathion gave complete mortality of nymphs and adults of *L. acuta* in 72 and 48 hours, respectively, whereas TEPP and toxaphene killed 12 and 19, respectively, of 30 nymphs in 72 hours and 28 of 30 adults in 168 hours; surviving nymphs transformed to adults in 96 hours. All three insecticides repelled both the nymphs and adults. Complete mortality of *C. medinalis* was obtained in 72, 168 and 96 hours, respectively, and of *S. incertulas* in 48, 144 and 144 hours. All insects fed to some extent on the treated plants, and the adults of *L. acuta* oviposited. There was no mortality on untreated rice until 168 hours after the beginning of the experiment, when some examples of *L. acuta* died of starvation.

Reyes (G. M.). **Rice Dwarf Disease in the Philippines.**—*FAO Plant Prot. Bull.* **6** no. 2 pp. 17–19, 2 figs., 4 refs. Rome, 1957.

The virus disease known as rice dwarf or rice stunt was first observed in the Philippines during the Japanese occupation in 1943–44 on upland rice grown in Manila. It disappeared with the destruction of most of the city in 1945, but reappeared in 1956 on seedling rice of varieties imported from the United States. The vector, *Nephotettix apicalis* var. *cincticeps* (Uhl.), is present in the Philippines, and in tests in which this Cicadellid was used to transmit the virus from the infected plants to nine local varieties of rice, all became infected to varying degrees. The stunting reported earlier [*R.A.E.*, A **30** 383] is considered not to be caused by the same virus, on account of the difference in symptoms.

Fukushi (T.) & others. **Studies on the Insect Transmission of Potato Witches' Broom.** [*In Japanese.*]—*Mem. Fac. Agric. Hokkaido Univ.* **2** no. 3 pp. 52–61, 1 pl., 31 refs. Sapporo, 1955. (With a Summary in English.)

The witches' broom virus disease has occurred sporadically on potato in Hokkaido since 1932. In 1953, a similar disease was observed on red clover and alsike clover [*Trifolium repens* and *T. hybridum*] in a field near infected potatoes. *Ophiola flavopicta* (Ishihara) was abundant on the clover, and this Cicadellid was tested for ability to transmit the viruses from clover and potato to potato seedlings. It transmitted the potato virus to 6 out of 23 seedlings and the virus from red clover to 3 out of 10, all infected seedlings showing symptoms typical of potato witches' broom. As *Vicia unijuga* growing near infected potato was also infected with a witches' broom disease, it was included in further tests. In these, *O. flavopicta* transmitted the virus from infected potato, clovers, and *V. unijuga* to healthy plants of these species, and it therefore appears that one virus is the cause of all

these infections. The virus probably hibernates in the roots of clover or *V. unijuga*, and is probably disseminated to potato by infected Cicadellids.

Ausland (O.). **Gulrotflua** (*Psila rosae* **Fabr.**). **Undersøkelser over dens biologi i Norge.** [The Carrot Fly (*P. rosae*). Investigations on its Biology in Norway.]—*Meld. Plantev.* no. 14, 68 pp., 30 figs., 47 refs. Oslo, 1957. (With a Summary in English.)

Psila rosae (F.) is a serious pest of carrots in Norway, where it occurs up to about 68° 50′N. lat. Investigations in the south in 1953–54 showed that losses varied considerably, but sometimes involved the whole of a crop, and damage was commonly as high as 30–40 per cent. All stages of the fly are described, and an account is given of observations on its bionomics. It has two generations a year as far north as 63° 28′N. lat., but the second is of importance only in favourable districts. Other umbelliferous crops are also attacked. Adults were found sheltering on various plants outside carrot fields, notably on red currant. Those of the overwintered generation survived for an average of 3·9 days in screen cages, and all were dead in nine days. The adults observed in carrot fields were almost all gravid females, and they were commonest in the late afternoon.

The emergence of the adults of the overwintered generation was spread over 55 days, beginning in late May or early June in the south and a month or more later in the north, and that of the first generation began at the end of August or in early September. Individual females contained 38–98 eggs each. The egg stage averaged 16 days at an average temperature of 12·5°C. [54·5°F.] and 11–12 days at 14·5°C. [58·1°F.], and counts of the larvae showed that 68 per cent. were in the roots and the remainder in the soil. Infestation was heaviest at the edges of a field. The larval stage lasted about a month for the first generation, and rather longer for the second, owing to the lower temperature, and pupation occurred mostly in the upper 4 ins. of soil.

Some individuals of both generations overwintered, and all pupae formed after mid-August did so. Mortality among the overwintering population ranged up to 70 per cent. Parasites that emerged from field-collected pupae comprised *Dacnusa gracilis* (Nees) and *Loxotropa tritoma* (Thoms.), and they formed 2–17 per cent. of all the adults emerging.

Papers noticed by Title only.

Nirula (K. K.) & Menon (K. P. V.). **Insect Pests of Coconut Palm in India.**—*FAO Plant Prot. Bull.* **6** no. 1 pp. 1–5, 17 refs. Rome, 1957. [*Cf. R.A.E.*, A **45** 337, etc.]

Synave (H.). **Insects of Micronesia. Vol. 6 no. 4. Homoptera: Cercopidae.**—pp. [3+] 213–230, 7 figs., 1 map. Honolulu, Bishop Mus., 1957. Carvalho (J. C. M.). **Vol. 7 no. 1. Heteroptera: Miridae.**—pp. [3+] 1–100, 58 figs., 1 map. 1956. Ross (E. S.). **Vol. 8 no. 1. Embioptera.**—pp. ii+ 1–8, 2 figs., 1 map. 1955. Hardy (D. E.). **Vol. 13 no. 1. Diptera: Dorilaidae (Pipunculidae).**—pp. [3+] 1–9, 6 figs., 1 map. 1956. Hardy (D. E.) & Adachi (M.). **Vol. 14 no. 1. Diptera: Tephritidae.**—pp. [3+] 1–28, 15 figs., 1 map. 1956. Gressitt (J. L.). **Vol. 17 no. 1. Coleoptera: Chrysomelidae.**—pp. ii+ 1–60, 19 figs., 1 map. 1955. Kulzer (H.). **Vol. 17 no. 3. Coleoptera: Tenebrionidae.**—pp. [3+] 185–256, 11 figs., 1 map. 1957. [*Cf. R.A.E.*, A **43** 345; **45** 332.]

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INDEX OF AUTHORS

Abul-Nasr, S., 27.
Adachi, M., 36.
Arnol'di, K. V., 10.
Attiah, H. H., 28.
Ausland, O., 36.

Baggiolini, M., 5.
Beckham, C. M., 14.
Bissell, T. L., 14.
Blache, M., 6.
Bocharova, O. M., 8, 10.
Bournier, A., 6.
Brandt, H., 2.
Brown, N. R., 12.
Busvine, J. R., 23.
Butler, F. C., 31.

Calora, F. B., 34.
Carvalho, J. C. M., 36.
Clark, P. J., 33.
Clark, R. C., 12.
Coulon, J., 7.

Descamps, M., 29.
Despotović, P., 5.
Dickson, R. C., 16.
Drees, H., 2.
Dupree, M., 14.
Dustan, G. G., 22.

El-Sawaf, S. K., 24.
Ezzat, Y. M., 27.

Fahmy, I., 28.
Farstad, C. W., 21.
Fedotov, D. M., 8, 10.
Fernando, H. E., 30.
Flock, R. A., 16.
Forte, P. N., 32.
Fox, C. J. S., 11.
Freitag, J. H., 15, 17.
Fukushi, T., 35.

Georghiou, G. P., 24.
Gradojević, Z., 4.
Greaves, T., 32.
Gressitt, J. L., 36.
Grylls, N. E., 31.

Habib, A., 25.
Hafez, M., 26.
Hammad, S. M., 24.
Hardy, D. E., 36.
Hassan, A. S., 26.
Hassanein, M. H., 28.
Holmes, N. D., 21.
Hurpin, B., 7.
Hutton, E. M., 31.

Jacks, H., 33.
Jenkins, C. F. H., 33.
Jewell, F. F., 17.
Johnson, M. McD., 16.

Kovačević, Z., 2.
Kulzer, H., 36.

Laird jr., E. F., 16.
Lazarević, B., 4.
Lienk, S. E., 19.

MacCollom, G. B., 20.
MacLagan, D. S., 20.
MacLellan, C. R., 11.
McMullen, L. H., 10.
Manickavasagar, P., 30.
Maramorosch, K., 16, 17.
Markkula, M., 1.
Menon, K. P. V., 36.
Mijušković, M., 5.
Milaire, H., 7.
Miller, L. A., 23.
Mirčetić, S., 5.

Narayanan, E. S., 12.
Nirula, K. K., 36.

Osman, F. H., 26.

Radović, M., 5.
Rayner, A. C., 12.
Read, D. C., 22.
Reeks, W. A., 11.
Reyes, G. M., 35.
Risbec, J., 30.
Rivera, C. T., 34.
Ross, E. S., 36.

Saunders, G. W., 32.
Schwitulla, H., 2.
Shepherd, R. J., 18.
Simons, J. N., 15.
Smalley, E. B., 18.
Smith, W. A., 32.
Soliman, A. A., 25.
Strogaya, G. M., 8.
Struble, F. B., 18.
Subba Rao, B. R., 12.
Synave, H., 36.

Takeshita, R. M., 18.
Tanasijević, N., 3.
Tinnilä, A., 1.

Ushatinskaya, R. S., 9.

Walker, A. J. K., 31.
Walters, J., 10.
Webb, R. E., 19.
Willison, R. S., 22.

Zaher, M. A., 26.
Zahradník, J., 14.

CONTENTS.

	PAGE
AFRICA: Records of Leaf-miners in Egypt	24
AFRICA: Laboratory Investigations on *Callosobruchus maculatus* in Egypt ...	24
AFRICA: Sprays against a Coccid on Olive in Egypt	25
AFRICA: Bruchids infesting *Trifolium alexandrinum* in Egypt	26
AFRICA: The Bionomics of *Tetranychus telarius* in Egypt	26
AFRICA: A Virus Disease of *Prodenia litura* in Egypt	27
AFRICA: *Orthezia insignis* in Egypt and its Control	27
AFRICA: The Egyptian Species of *Brevipalpus*	28
AFRICA: Mites injuring Fruit Trees in Egypt	28
AFRICA: Abundance of Insects taken in Light-traps in Egypt	28
AFRICA: Rice Borers and their Parasites in French Cameroons ...	29, 30
AUSTRALIA: New Insect-borne Virus Diseases of Pasture Plants	31
AUSTRALIA: Malathion for Control of *Sminthurus viridis*	31
AUSTRALIA: Experiments against *Vasates lycopersici* in Queensland	32
AUSTRALIA, WESTERN: Dieldrin controlling *Iridomyrmex humilis*	32
AUSTRALIA, WESTERN: An Outbreak of *Cydia pomonella*	33
BRITAIN: Observations on *Eulecanium taxi* and *E. corni*	25
CANADA: The Life-history of *Pseudohylesinus nebulosus*	10

[*Continued on p. iv of cover*

CONTENTS—*cont.*

	PAGE
CANADA: Carabids and Staphylinids feeding on Wireworms	11
CANADA: Sequential Sampling for Larvae of *Operophtera brumata*	11
CANADA: Field Identification of three Predators of *Chermes piceae*	12
CANADA: Effects of Exposure on immature Stages of *Cephus cinctus*	21
CANADA: *Drosophila* and Fungi infesting Peach Fruits	22
CANADA: Insecticides against *Melittia cucurbitae* on Squash	23
CEYLON: The Control of *Helopeltis* on Cacao	30
CYPRUS: A Malathion Bait-spray controlling *Ceratitis capitata* on Apricots ...	24
FINLAND: The Bionomics of *Hypera nigrirostris*	1
FRANCE: Thrips causing Deformation of Peaches	6
FRANCE: Observations on *Ceratitis capitata* in the Rhone Valley	7
FRANCE: BHC and Aldrin against Larvae of *Melolontha melolontha* ...	7
GERMANY: Pests and Diseases of agricultural Crops (*Review*)	2
GERMANY: *Apanteles solitarius* parasiting *Lymantria dispar* on Fruit Trees ...	2
INDIA: Insect Pests of the Coconut Palm (*Title only*)	36
JAPAN: A Cicadellid Vector of Potato Witches' Broom	35
MEXICO: Two Types of Maize Stunt Disease	17
NEW ZEALAND: The Schradan Content of Fruits and Vegetables	33
NEW ZEALAND: A Comparison of Sprays against *Bryobia praetiosa*	33
NORWAY: The Bionomics of *Psila rosae* on Carrot	36
PACIFIC IS.: Insects of Micronesia (*Title only*)	36
PHILIPPINE IS.: Tests of Insecticides against Pests of Rice	34
PHILIPPINE IS.: The Occurrence of the Rice Stunt Disease	35
SWITZERLAND: *Tortrix rosana* on Apple and its Control	5
U.S.S.R.: Investigations on *Eurygaster integriceps* in Krasnodar	8
U.S.A.: *Diaphania nitidalis* on Cucurbits in Georgia and its Control	14
U.S.A.: An Aphid-borne Virus of Bell Pepper	15
U.S.A.: Galerucids transmitting Squash Mosaic	15
U.S.A.: Aphids and the Spread of Tristeza Disease of *Citrus*	16
U.S.A.: Nitidulids and the Fungus causing Oak Wilt	17
U.S.A.: Cicadellids transmitting the Virus of Aster Yellows to Cucurbits ...	17
U.S.A.: *Aceria tulipae* infesting Garlic in California	18
U.S.A.: A Grasshopper transmitting a Virus to Watermelon	18
U.S.A.: Identity of an Aphid-borne Virus Disease of Cereals	18
U.S.A.: Activated Charcoal and Injury to Cucurbits by DDT	20
YUGOSLAVIA: Suitability of alternative Food-plants of four Lepidoptera ...	2
YUGOSLAVIA: The Life-history of *Tychius flavus* on Lucerne	3
YUGOSLAVIA: *Meigenia bisignata* parasitising *Phytodecta fornicata*	4
YUGOSLAVIA: The Bionomics and Control of *Rhynchites auratus* on Cherry	4
YUGOSLAVIA: Parathion against *Dacus oleae* on Olives	5
YUGOSLAVIA: A Test of Phosphine as a Grain Fumigant	5
YUGOSLAVIA: Sprays against *Ceroplastes rusci* on Fig	5
Comparative Toxicity of Insecticides to *Platyparea poeciloptera*	7
Estimation of dyed Spray Deposits on Filter Paper	12
Effects of different Hosts on *Bracon gelechiae*	12
Dates of Description of *Quadraspidiotus schneideri* and *Q. mařani*	14
Semi-automatic Injection of Liquids into Insects	16
Relation of Temperature to Transmission of Potato Leaf-roll Virus	19
Taste Evaluation of Apples sprayed with Ovex	19
Effects of Insecticides on the Growth of Plants	20
An Apparatus for removing Puparia from Soil	22
The Techniques for testing Insecticides (*Review*)	23

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